

SCIENCE

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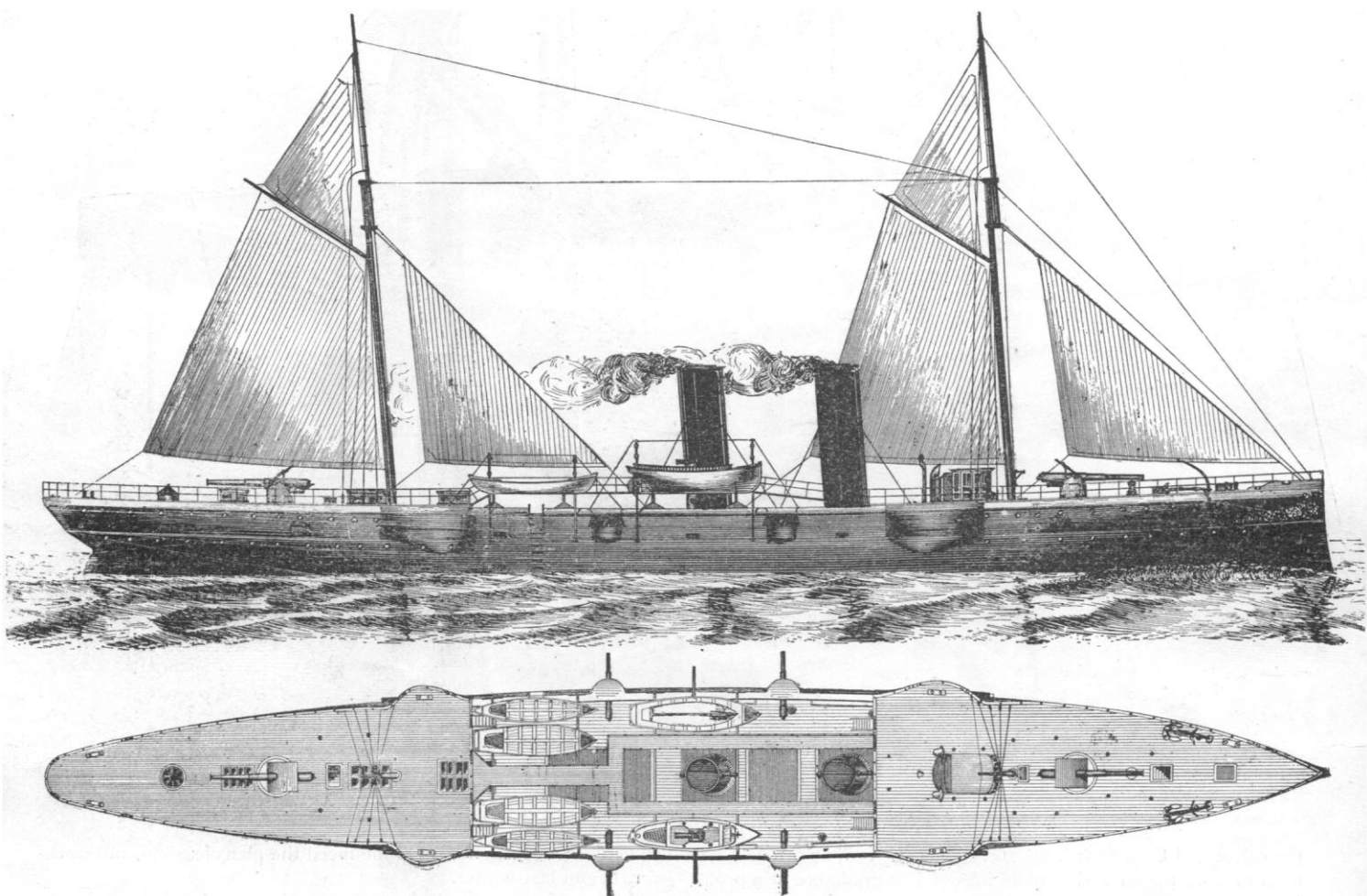
NEW YORK, JUNE 21, 1889.

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THE NEW TWO-THOUSAND-TON CRUISERS.

THE new 2,000-ton cruisers authorized by an act of Congress approved in September, 1888, are improvements on the Yorktown and Concord class of vessels, being somewhat larger, and intended to make higher speed. They are twin-screw protected cruisers, having, in addition to coal protection to the machinery, a curved steel deck covering the magazines and steering-gear, besides the

These vessels, in their batteries, show how the modern idea of a ship's armament has changed, even in the short time that has elapsed since the United States began the rehabilitation of the navy. Guns of heavy calibers and few in number have gradually given place to those lighter in weight but greater in number, and capable of firing in a given time a much greater weight of projectiles. The main batteries of these vessels, which are the first to carry rapid-fire guns in the primary battery, will be made up of two



NEW 2000-TON CRUISERS.

engines and boilers, and also a coffer-dam protection extending throughout the entire machinery space. The interior arrangements of quarters are thought to be better than those aboard any of the other vessels, and present many innovations that will without doubt meet the hearty approval of those detailed to occupy them. The ventilation and lighting of all below-deck quarters, storerooms, passages, and so forth, are of the latest approved designs, and will conduce greatly to the health, comfort, and contentment of officers and crew.

six-inch and eight four-inch rapid-fire guns; the secondary batteries being two six-pounders, two three-pounders, two revolving cannon, and one Gatling gun. The motive power for the twin screws is furnished by two triple-expansion engines of 5,400 horse-power. The boilers are of steel, five in number, of the return fire tubular type, designed for a pressure of 160 pounds. Three of these boilers are double-ended; and the others, to be used as auxiliaries, are single-ended. The engines and boilers are in separate water-tight compartments. There will be independent air and circulating

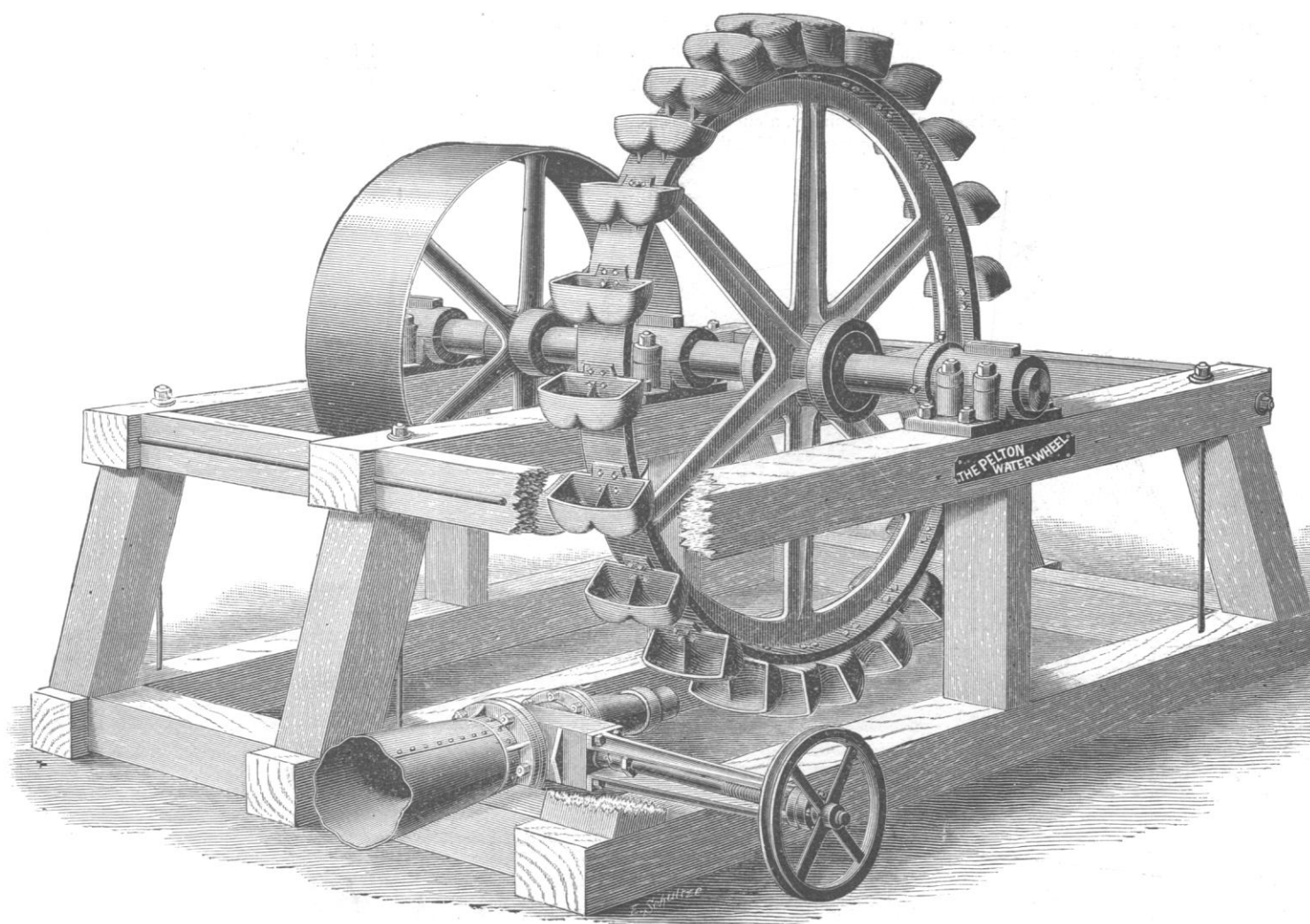
pumps, and auxiliary condensers, and pumps for the auxiliary machinery. The torpedo outfit for auto-mobile torpedoes, probably of the Howell type, will consist of six launching-tubes, — one forward, another aft, and two on each broadside, — and in addition there will be the usual outfit of boat torpedoes. The rig is that of a two-masted schooner of small sail area, steam being the motive power on which the main dependence will be placed. The cost of these cruisers will be \$700,000 each. The bids for them will be opened in August next.

ELECTRICAL POWER TRANSMISSION AT VIRGINIA CITY, NEV.

"MORE power, economical power," has now for several years been the imperative demand of the owners of mining properties on

At the stamp-mill of the Nevada Mill and Mining Company, water-power was obtained at the level of the mill from a reservoir on the side of the mountain. The mill contains 60 stamps, with their complement of pans, settlers, agitators, rock-breakers, etc. The water-power readily available was entirely inadequate for the operation of the mill.

The problem was submitted to the Brush Electric Company through its agents, the California Electric Light Company of San Francisco. A solution was speedily offered, and the plans were accepted by the owners of the Nevada Mill and Chollar Mine. The shaft of the latter is close to the stamp-mill. It was proposed to collect the waste water from the surface wheel at the mill, convey it in pipes to the shaft of the Chollar Mine, and thence down the shaft until a sufficient head should be obtained to produce the power required. The scheme was novel, and presented many diffi-



THE PELTON WATER-WHEEL USED UNDER 1680 FEET HEAD IN THE CHOLLAR MINE.

the celebrated Comstock Lode at Virginia City. The problem has been to work the enormous quantities of low-grade ore at a profit. Large sums have been expended in carrying water from streams in the neighboring Sierra Nevada Mountains for a distance of some thirty miles, to be utilized at the mines and mills on the Comstock. But this supply of water is limited and variable, and by no means meets the demand. Operations have frequently been suspended on this account, causing great loss to the mine-owners, and hardship to the laborers dependent upon the active working of the ores.

The best engineering talent of the country has been called to work on this vital problem of power-supply, and new arrangements have been made for increasing the amount of water; but vast powers now within reasonable range are still running to waste, which the use of electricity alone can conserve.

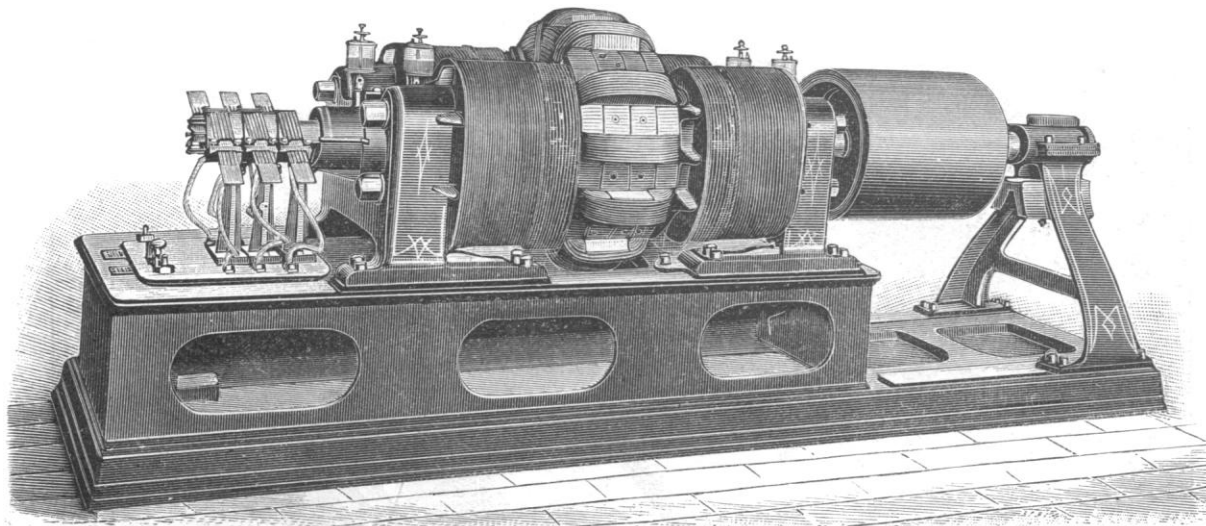
culties. However, experts pronounced the plans feasible, and work was begun last winter.

At the 1,650-foot level of the Chollar Mine a subterranean chamber was excavated out of solid porphyry for the reception of the dynamo electric generators and water-wheels. This chamber is 50 feet in length by 25 feet in width, and 12 feet in height, clear of all timbers. From the tank containing the waste surface water, two wrought-iron pipes are led to the subterranean chamber, one 10 and one 8 inches in diameter. At the bottom of the shaft a Y unites these two pipes into a single one 14 inches in diameter, out of which six 6-inch pipes run to the nozzles of the water-wheels provided to drive the large Brush dynamo electric generator.

The underground electrical station is of the most interesting character, and is shown in our illustrations. The large Brush pri-

many generators, of which there are six, are adapted to the conditions by a few mechanical changes from the standard pattern. They are mounted on a heavy cast-iron base, and are provided with an extended shaft and outer bearing. On the armature shaft, and between two bearings, the Pelton wheel is mounted and enclosed in a water-tight cover. The cut of the generator is made from a photograph taken at the Brush Electric Company's works

excellent forms of water-wheels, the Pelton was selected as best adapted to work under the special circumstances. This wheel is the outgrowth of the old hurdy-gurdy form, and, as will be seen from the illustration, its buckets are provided with a very ingenious wedge-shaped partition, by which the stream of water is divided, and sweeps out through the curved sides in such a way as to produce a re-actionary effect in addition to the impact. By the pe-

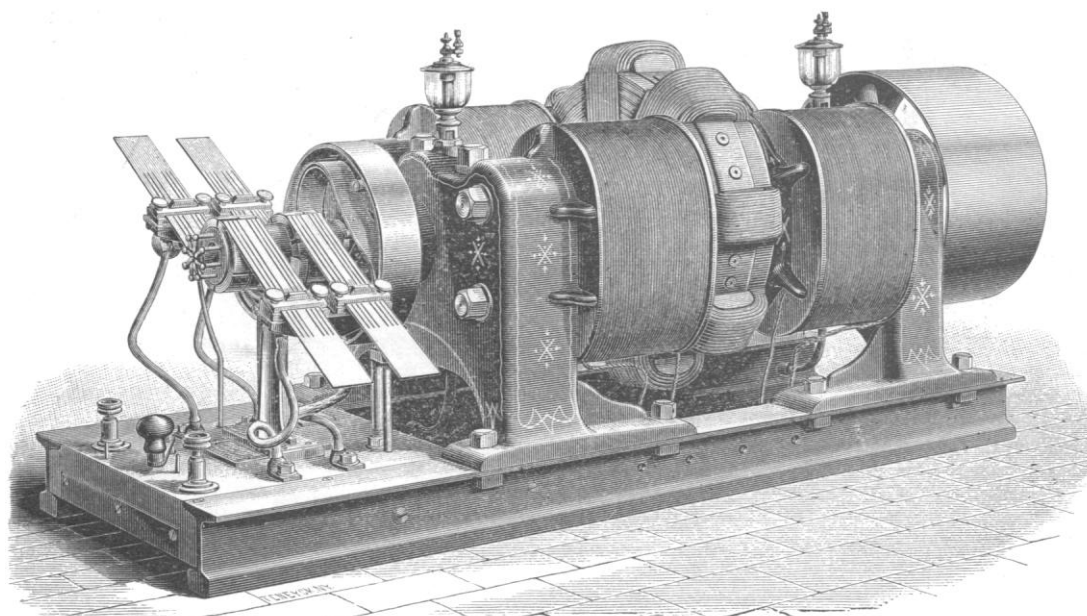


BRUSH DYNAMO, CHOLLAR MINE.

at Cleveland, before shipment, and shows a pulley on the armature shaft, arranged for testing-runs at the factory. The water-wheel is attached to the armature shaft at the place occupied by this pulley, and a coupling is provided for detaching this entire end of the shaft carrying the wheel from the other end carrying the armature.

These Brush generators are each of 130-horse-power capacity,

and the peculiar construction of the buckets, all the water is also thrown down and out of the way of the wheel. The six Pelton wheels are each 40 inches in diameter, are made of phosphor-bronze, and weigh 220 pounds. They drive the generators at the rate of 900 revolutions per minute. The compact arrangement of combined dynamo generator and water-wheel makes it almost impossible for the visitor to the underground chamber to realize the enormous



BRUSH ELECTRIC MOTOR, EIGHTY HORSE-POWER, NEVADA MILL.

and are compound wound for constant current. The electrical curve from these machines is almost ideally perfect, and they require no regulator whatever. The current remains of constant strength under all conditions of load.

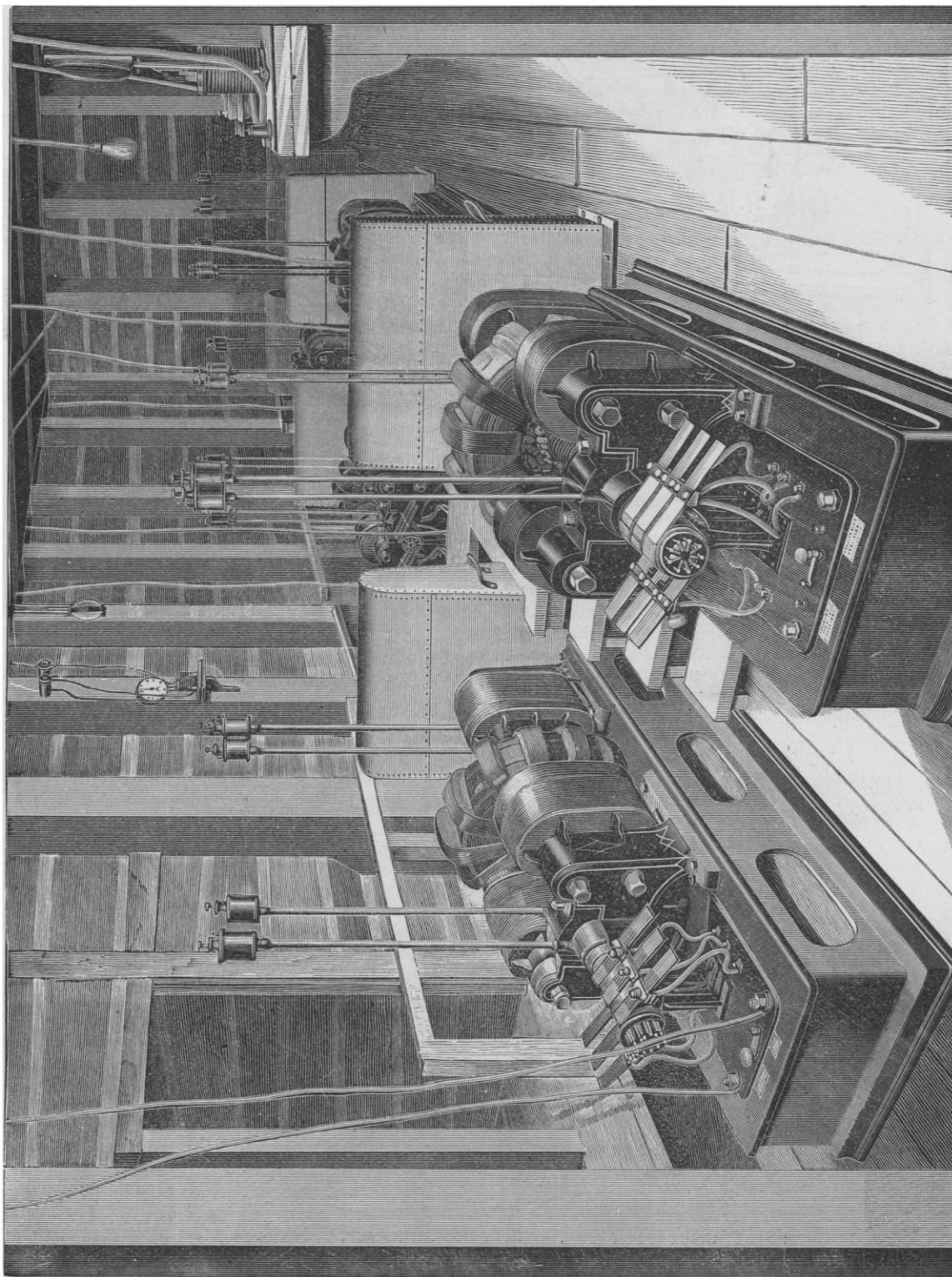
The head of water at the underground chamber is 1,680 feet. It has never before been attempted to run a water-wheel under such enormous pressure. This was indeed one of the most serious problems involved in this remarkable installation. From the various

amount of power here at work. The machines are placed in parallel rows of three, and the swift-revolving armatures are all that can be seen in motion as evidence of the 800 horse-power generated. The chamber is brilliantly lighted by 36 Swan incandescent lamps, operated in multiple series from one of the Brush generators, and there are several of the same lamps in the incline. Each generator circuit is provided with a dead-beat ammeter of the Brush pattern; and a Brush voltmeter is also at hand, which is

capable of measuring up to 3,000 volts. The generator circuits are led to a switch-board in the same dynamo-room, where any generator can be thrown on to any one of the outgoing motor circuits.

Leaving this subterranean power station, and ascending the

The electric-motor room is shown in one of the large illustrations. The six motors are of the regular Brush constant-current type, each of 80-horse-power capacity, and are arranged in a single row parallel with the main driven shaft, to which they are all belted in the ordinary manner. The surface water-wheel is also



UNDERGROUND BRUSH POWER STATION AT THE 1650-FOOT LEVEL OF THE CHOLLAR MINE.

Chollar shaft, are the circuits of copper wire, one to each generator. At one point these circuit wires pass through a shower-bath of spray, but the insulation is so perfect that no leakage has yet developed. The wires issue from the mine shaft, and are carried above ground to the electric-motor room at the Nevada Mill. The total length of each circuit is a little more than a mile.

connected to this same shaft. It will be noted that there is here a very novel and interesting feature. This surface wheel uses the water in the first instance, and furnishes part of the power to drive the main shaft. The waste water, after this primary use, is carried down the Chollar shaft to the underground chamber, where it drives the dynamos which generate the electric current and ener-

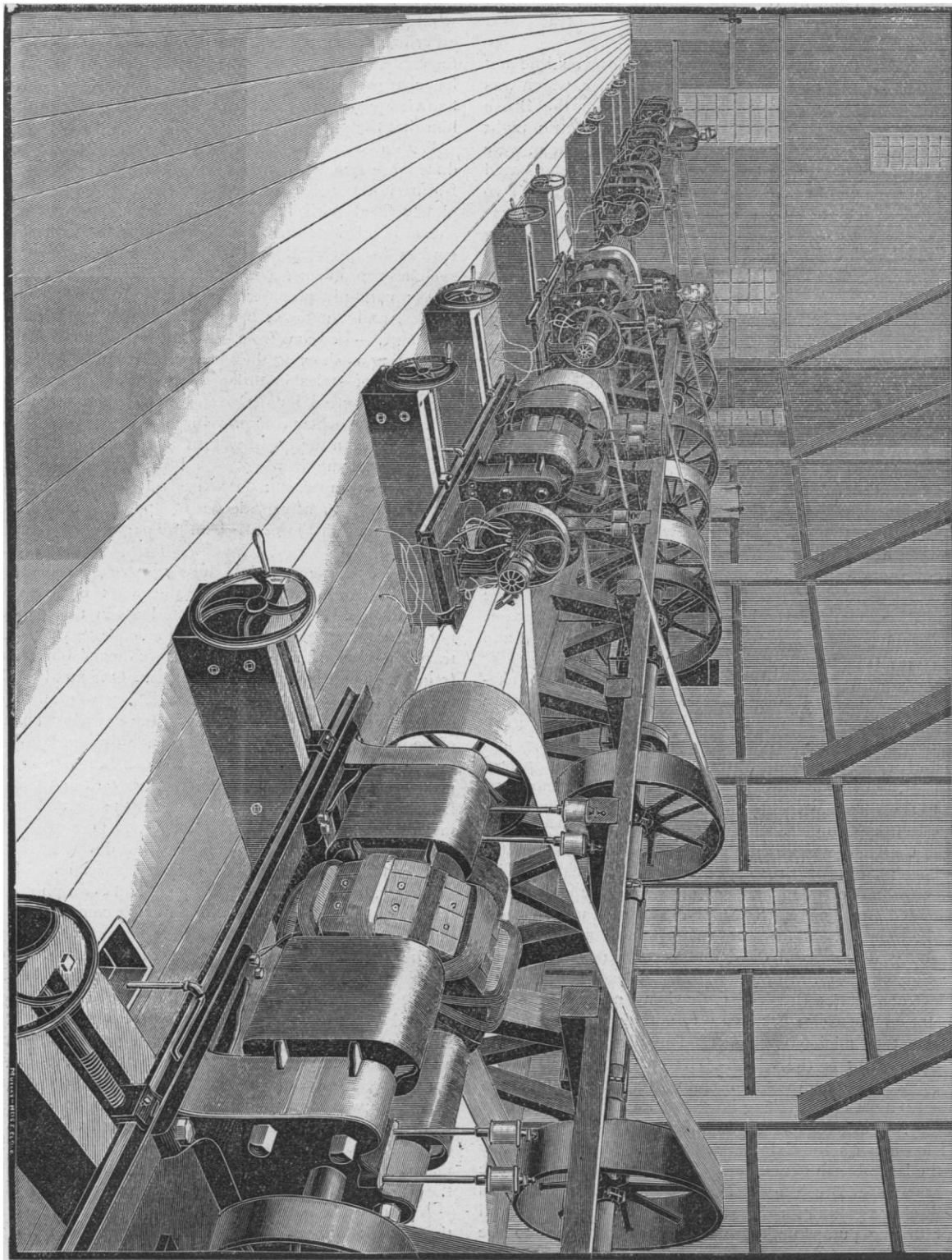
gize the electric motors above ground, which in turn furnish additional power to the main shaft.

Each electric motor has its own independent circuit fed from one of the generators. The well-known Brush centrifugal governor, with which each motor is fitted, regulates the speed sensi-

none was encountered. The motors have not given a moment's trouble or annoyance of any kind from the start.

Some idea of the economic value of this electric power plant to the mine-owners may be got from a statement of the saving effected by it. The surface wheel alone requires 312 miner's inches of

BRUSH MOTOR-ROOM AT NEVADA MILL.



tively, and all or any number of the motors work perfectly in a battery together or with the water-wheel. In the motor-room there is also an ammeter for each electric motor, to show at all times the current flowing in each circuit. The motors run at a speed of 850 revolutions per minute. Some difficulty was anticipated in operating the motors together on one shaft in the manner described, but

water to develop power sufficient to drive 40 of the 60 stamps with which the mill is equipped. Moreover, this amount of water is seldom available. Two of the electric motors, working in addition to the surface wheel, will perform the same service with but 72 miner's inches of water, thus effecting a saving of about 77 per cent.

The net commercial efficiency of the plant, taking into account all elements of loss, including that in the conducting wires, is about 70 per cent: in other words, 70 per cent of the power applied to the shafts of the generators in the underground chamber is delivered for work at the main line shaft in the mill.

The waste water from the 1,650-foot level of the Chollar Mine is piped into the Sutro Tunnel. It is now proposed to use this water a third time at a lower level for other work, by means of a similar application of electrical machinery.

It was expected at the outset that many difficulties would be met in an installation of such novel and original character, which was also by far the largest ever attempted. The projectors, the Brush Electric Company and their agents, the California Electric Light Company, who assumed charge of the details of the erection, were very greatly pleased to find that their forethought had eliminated the troubles anticipated and predicted in almost all respects. Two purely technical difficulties were encountered when the plant was started experimentally, which caused some delay and anxiety. They were, first, the lack of any governing appliance for the water-wheels; and, second, the damage to the primary generators caused by the extreme heat and dampness in the underground station.

The Brush Electric Company, in its original plans and specifications, stipulated that the water-wheel should be governed within reasonable limits; but this requirement was not met, and the first generator and motor, started up experimentally, showed the necessity of this provision. The Brush Company was surprised to receive by telegraph the first intimation that the makers of the water-wheels had wholly neglected such an important matter, but was fortunately able to close the breach at once. A water-wheel governor, invented and sketched out by Mr. W. B. Devereux, the prominent mining engineer, of Aspen, Col., had been placed in the hands of the company some time previously, and working drawings of it had been made at Cleveland. These were at once sent to California, the governors were quickly made, and this source of trouble was overcome. Mr. F. E. Smith, the electrical engineer in charge of the installation, made several modifications of the governor, after watching its performance, which proved of much value, and it has worked perfectly in practical service.

The second difficulty was met with equal promptness, and likewise entirely overcome. The temperature of the subterranean power chamber is about 72° F. The atmosphere is almost saturated with moisture, — 78 per cent. Any piece of metal taken into it begins immediately to "sweat." The generators, when placed in this chamber, were soon covered and saturated with moisture, and began to show leaks, while the motors above ground were absolutely free from any trouble.

The Brush Company was at once notified of this unanticipated source of difficulty, and Mr. Brush speedily devised a method of insulation which would certainly and completely resist the moisture of the sublimated atmosphere. Since its application the generators have worked admirably, and the entire plant is now at work regularly, performing its expected duty, and economizing the power available, as stated above.

The achievement of the Brush Electric Company, in connection with this plant on the Comstock, is a very notable one, and of the greatest interest to mining engineers. The plant is the largest electrical power plant in the world. The company is making a specialty of powerful generators and motors for power transmission and distribution, and is taking large orders for them, not only in this country, but also for foreign shipments. The latest contract announced is one with the Calumet and Hecla Mining Company for five of the large Brush generators of 130 horse-power, and five of the 80 horse-power Brush motors. A power station will in this case be built above ground for the generators, and the motors will be used for driving pumps underground. The plant goes to the copper-mine at Calumet, Mich.

A MODEL SCHOOL OF ARCHITECTURE.

THE department of architecture of Columbia College has closed its work for the year with its annual exhibition of drawings. This department was organized eight years ago largely through the liberality of Mr. F. A. Schermerhorn, who contributed the neces-

sary funds to place it on a firm basis. It has grown with unusual rapidity, and is now one of the strongest parts of the School of Mines of Columbia College. During the past year, sixty-five students were registered in the department, an increase of twenty-five over the preceding year. The money furnished by Mr. Schermerhorn has enabled the trustees to supply a liberal collection of apparatus, models, books, photographs, and drawings; and the whole forms a collection of working material not equalled by another institution of the same kind in the country. Columbia is fortunate, also, in possessing in Professor William R. Ware, who has charge of this course, a teacher who combines sound technical knowledge with a warm sense of architectural form, and it is to him that the success of this school of architecture is chiefly due.

With a large body of students it is, of course, possible to produce large quantities of work, and this was the first noticeable feature in the recent exhibition. Four or five rooms were completely filled with the work of the students. Specimens were shown in all departments of architectural drawing. There were studies in historical ornament, many of them highly spirited sketches; problems, with details and perspectives; original designs; carefully prepared elevations; studies in perspective, in shades, and shadows; pencil drawings from the cast; memory drawings, — sketches from descriptions of photographs, and highly interesting as showing the attention that must have been given to the study of styles in order to produce such results; free-hand sketches of actual buildings and from photographs; applications of design and water colors. Nor was the quality of the work less noticeable than the quantity. In a collection of the work of an entire year, some drawings would be necessarily included that are more or less imperfect; but there were few of these, and they all evinced an extraordinary degree of application on the part of the students, and untiring energy on the part of the teachers and instructors.

Many of the pen-and-ink drawings were exquisitely done, and compared very favorably with the work of more experienced draughtsmen. The work of the students in this department does not cease with the conclusion of the college year. On the contrary, they are encouraged to enter architects' offices, and to make frequent sketches during the summer. One hundred drawings are required to be handed in at the beginning of the college year as evidences of summer work, though each day passed in an architect's office is accepted as the equivalent for a drawing. The hand and mind of the student are thus kept in constant practice, and there is no doubt but that much of the superior work in this school arises from the fact that the work is constant the year round, and is not interrupted by three months of idleness. One of the most interesting sections of the exhibition was that devoted to summer work. The exhibit was large, and included specimens of all kinds of drawings, both from actual buildings and from photographs. The quality of the subjects was an interesting commentary on the manner in which the tastes of these young men had been trained.

The problems of execution included a staircase, with perspective and detail drawings, elevation and details of a classical window, and several other subjects. All these were class-work, and were marked with the criticisms of the professor. Another interesting series were designs for a wrought-iron gate, and some studies for a Roman villa, by the first-year students. Space does not permit, nor is it necessary, to enumerate all the drawings shown. The exhibition was one to have been seen to be appreciated. The work was characterized not only by marked ability on the part of the students, but also testified to the great care and thought displayed by the teachers. The drawings showed an enthusiasm for the work which is not always to be found among undergraduates.

A word as to methods. The course in architecture extends over three of the four years' course in the School of Mines. The first college year is devoted by all the students to general studies; but in the second year the class is divided into sections, each pursuing a technical study. In the course in architecture, drawing is an important feature throughout the three years. In the first year the elements of architecture, with the forms and proportions of the five orders, are taught, together with the study of Greek and Roman architectural history. In the second year technical studies in the mechanics of solids are introduced, and a survey made of the ma-

terials employed in construction, their application and uses. In the fourth year, studies in the properties of materials are continued, and contracts, specifications, superintendence, and the details connected with the practical work of the architect, are considered. Throughout the whole course there are lectures and exercises in the history of architecture, as well as in the history of painting and sculpture, the aim being to make the students familiar with designs and styles which they might never even see in the daily routine of an architect's office.

The future of the department of architecture in Columbia College promises to be unusually brilliant. The trustees of the college have recently established a two-years' fellowship in architecture, which is the most valuable prize now open to architectural students in America. The conditions under which this will be awarded have not been decided as yet; but it will doubtless be a travelling fellowship, open to all the graduates of the department, thus enabling the recipient to pass two years in travel abroad. The income amounts to \$1,300 for the two years. New York will soon possess, in the Museum of Architectural Casts now being prepared for the Metropolitan Museum of Art, the finest collection of architectural models in the world. No part of this collection is yet in place, though a portion of it has been received at the museum, and the promises of the museum authorities indicate a collection of extraordinary value and interest. With this collection within easy reach, Columbia College will stand easily in the front rank of architectural schools in this country, and will compare favorably with the best in Europe. Each year witnesses some new improvement to the department, both in the way of teaching and in the apparatus. The schools of architecture in this country are limited in number, and it will require hard work on the part of the others to keep abreast with Columbia.

BARR FERREE.

NANSEN'S EXPEDITION ACROSS GREENLAND.

DR. FRIDTJOF NANSEN, whose daring expedition across the inland ice of Greenland excites so much well-merited admiration, gives the following description of his dangerous trip:—

"In the beginning of May, 1888, myself and the companions whom I had selected, Lieut. Dietrichson, Capt. Sverdrup, Mr. Christiansen, and the Lapps Samuel Balto and Ole Ravno, were ready to leave Christiania. After having reached Scotland, we sailed on the Danish steamer 'Thyra' for Iceland, whence the Norwegian sealer 'Jason' took us across Danmark Strait to the east coast of Greenland. The 'Jason' is a wooden steamer with full rigging. She is built for navigation in the ice-covered polar seas. Her bow is strengthened in order to withstand the heavy pressure of the ice setting along the east coast of Greenland. I hoped to find the ice sufficiently loose to permit us to reach the mainland by means of boats in the beginning of June. On June 11 we sighted the coast north of Angmagssalik, where Capt. Holm's expedition wintered in 1884-85. We approached the land to within forty miles, but here our progress was stopped by the ice. As it seemed to fill the sea as far as the coast, I did not feel justified in an attempt to force a landing. For this reason we staid on the 'Jason,' which went sealing in Danmark Strait. After the sealing was finished,—about the middle of July,—we approached the coast of Greenland for a second time. At this season the belt of ice was not by any means as extensive as it had been in June. On July 17 we approached Angmagssalik to within twelve miles, but we were again arrested by a heavy pack. As I supposed that we should be unable to approach any nearer the coast, I resolved to leave the steamer, and to attempt a landing. We left the 'Jason' with two boats, which were about twenty feet in length. Besides the boats, we carried a tent, two sleeping-bags made of deer-skin, and five long and narrow sledges for carrying provisions, ammunition, instruments, etc.

"In the beginning we made fair progress, as the ice was sufficiently loose to permit our boats to pass between the floes. Eventually we had to cut off a projecting point, but no serious obstacles were met with. At a few places we had to drag the boats over a floe, but our progress warranted the hope that we would reach the mainland on the following day. The farther we progressed, however, the closer the ice was packed, and the oftener the boats had to

be dragged over the ice. On one such occasion one of our boats was stove. She was unloaded as quickly as possible, and the necessary repairs were made. Thus four hours were lost. When we were ready to start, we found the ice so closely packed that we had to drag the boats continually. Travelling was made still more difficult when heavy showers of rain set in. We were thoroughly tired out, and it was necessary to encamp on the ice in order to regain strength to await the loosening of the pack. While we were encamped, the current carried the ice rapidly southward, and the distance to the coast was rapidly increasing. When it cleared up again, we discovered that we were about fifteen miles south of Sermilik Fiord. We endeavored to reach the coast; but travelling was extremely difficult, as the ice consisted of small and closely packed floes. Besides this, the current continued to carry us southward, and it seemed that the distance which separated us from the coast was continually increasing. Thus the day was spent. The weather was fair, but the current thwarted all our endeavors. At one time we were close to the shore; then the current carried us far out into the sea, and we felt the heavy swell of the ocean. One night, when sleeping in our tent, we felt a heavy swell, and the small floe on which we had pitched our tent was subjected to heavy pressure. On the next morning we saw that the floe was cracked near our camp, and that we were close to the edge of the pack near the open sea. The boats were made ready, and preparations were made to leave the ice. At night we had approached the edge of the pack still more closely. The sea washed over our floe, the size of which was rapidly decreasing. We knew what was before us. In order to be ready to take up the struggle with full strength, I ordered everybody to turn in. Sverdrup was ordered to watch, and to call all hands when it should be necessary to leave the floe. Sverdrup, however, did not call us, and when we arose on the next morning we heard the breakers at a long distance. During the night our floe had been so close to the sea that one of our boats was threatened by the waves; but all of a sudden it was drawn towards the land, and entered the pack-ice.

"After a few days the current carried us so close to the land, that we were able to reach the coast. On July 29 we went ashore near Anoritok in 61° 30' north latitude. During our twelve-days' stay on the ice, we were carried southward sixty-four miles. On the whole, the weather had been fair. Now we were on shore, but far southward from the point where I had hoped to reach Greenland, and where I intended to begin my journey inland. Therefore we had to go northward along the coast, as I was unwilling to change my plans.

"We started on the journey along the coast in the best of spirits. Whenever the ice was too close to the shore, we had to cut our way by means of axes, and we succeeded in making slow progress. On July 30 we passed the glacier Puisortok, which is so much feared by the East Greenlanders. On a point at the north side of the glacier we fell in with a party of natives who had visited the west coast on a trading excursion. This party, who were travelling in two women's boats, had met another party travelling in two boats, who were going southward on a visit to the west coast. We pitched our tent alongside their camp, paid them a visit, and were kindly received. On the next day we travelled in company with the first party northward, and reached the island of Ruds. The Greenlanders let us take the lead, in order to make use of the clear water made by our boats. In the afternoon rain set in. The Eskimo pitched their tents, while we continued our journey. Everywhere the ice lay close to the shore, and huge icebergs were pushed into the sea by the glaciers. At Tingmiarmiut we heard the dogs of the Greenlanders howling; but we had no time to spare, and continued our journey. On Griffenfeldt's Island we were overtaken by a northerly gale. At Akornarmiut we fell in with a new party of natives. They, however, were extremely timid, and as soon as they saw us they took to their heels, leaving behind their tents and one dog. We succeeded, however, in making friends with them by giving them a number of trinkets as presents, and on parting we were sincere friends. Numerous kayaks accompanied us when we continued our journey.

"Finally, on Aug. 12, we reached Umivik, whence, under the existing circumstances, I intended to start on my trip across the

inland ice. At this place the ice reaches the sea. Only a few *nunataks* (summits of mountains) emerge from the ice, while there are no extensive stretches of land. A few days were spent in necessary preparations. Our boats were hauled on shore, turned upside down, and in one of them our spare ammunition was stored, in case we should be compelled to retrace our steps and winter on the east coast.

"On Aug. 15 we started inland. Our baggage was packed on five sledges, of which Sverdrup and myself dragged the heaviest one, while the others dragged one each. Every one had to drag a load of two hundred pounds, — a task which was made very difficult by the comparatively steep ascent of the ice, which was crossed by numerous deep fissures. During the first and second days we made fair progress, particularly as we slept during the day-time, and travelled at night on harder and better ice. On the third day we were overtaken by a terrible rain-storm, which detained us for three days. Then we proceeded in regular marches without meeting with any serious obstacles. The ground rose continually. The snow was hard but uneven. Thus we had proceeded for nine days in the direction of Christianshaab, the colony on the west coast which we tried to reach. Then, all of a sudden, a strong and continuous snow-storm set in. The road began to be bad, and we made slow progress. I saw, that, under these circumstances, it would take a long time to reach Christianshaab. It was near the end of August, and I expected that it would be extremely difficult to travel on the inland ice as late as September. On Aug. 27 I resolved to change my course, and to attempt to reach Godhaab. Thus we shortened the distance to be traversed; and the snow-storm, which for several days had blown right into our teeth, was more favorable to us, and helped us to drag our sledges. On the other hand, I knew that the descent from the inland ice to Godhaab would be much more difficult than at Christianshaab; but we resolved to make a boat, in case the land near Godhaab should prove too difficult.

"We were in about 67° 50' north latitude, and about forty miles distant from Godhaab Fiord, when we changed our course. Our sledges were provided with sails, for which purpose we used pieces of cloth. For three days we travelled on in this way; then the wind calmed down. Travelling became very difficult, and we had to use snow-shoes in order to prevent sinking into the snow. The surface was level and without fissures, but the ground was rising continually. It was not until the beginning of September, when we had reached a height of nine thousand or ten thousand feet, that we had reached the top of the plateau. We were on an enormous plain, level as a floor, and like a vast frozen sea. The snow was loose and fine. Small needles of ice were falling continually, and the temperature was so low that the mercury became solid. Unfortunately, I had no alcohol thermometer to show the lowest temperature, which must have been between 40° and 50° below zero. One night the minimum next to my pillow was — 31° F. We did not suffer, however, with the cold, except during a snow-storm.

"At last, on Sept. 19, a favorable easterly wind began to blow. We tied the sledges together, set sail, and made rapid progress westward. We were descending at the same time. In the afternoon we discovered the first mountain of the west coast. At night I suddenly discovered through the falling snow a dark spot, which we approached without fear of any danger. When we were at only a few steps distance, I discovered that the dark spot was a fissure. We succeeded in stopping the sledges at a few feet distance, but thereafter we proceeded more cautiously.

"The ice grew more impassable the more closely we approached the coast. Besides this, we had to change our course, as we had entered the great glacier emptying into Godhaab Fiord. On Sept. 24, at a small lake south of Kangarsunek, we finally reached the land. Here we left part of our sledges and provisions, and went along the river Kukasik toward Ameragola, where we arrived on Sept. 26.

"Thus the inland ice was crossed; but we had to reach an inhabited place as soon as possible, as our provisions began to be exhausted. Besides this, our throats and mouths were swollen and sore by the long-continued use of pemmican. It was impossible to reach Godhaab by land, and we turned to building a small boat.

The felt floor of our tent was used as a cover of a frail frame which was built of willows and of a few poles. On Sept. 29, Sverdrup and myself started for Godhaab, while the others went to fetch the rest of our baggage from the edge of the inland ice. With great difficulty we succeeded in reaching New Herrnhut, a missionary station, on Oct. 3. After a visit to the missionary, we proceeded to Godhaab, which lies a short distance off. We were received very kindly. Two kayaks, with the necessary implements, were despatched at once to Ameragola to fetch the rest of our party. Unfortunately they were delayed by stormy weather, and we did not meet at Godhaab until Oct. 12. An attempt to return to Norway on the steamer 'Fox' from Ivigtut failed; but I must confess that I do not regret the necessity of having wintered in Greenland, as I had thus an opportunity to make a thorough acquaintance with the Greenlanders."

Thus Dr. Nansen concludes his preliminary report, which is soon to be followed by a scientific report. On April 16 the ship 'Hvidbjörnen' arrived at Godhaab, and on April 25 Dr. Nansen and his party left this place. After a brief stay at Sukkertoppen, which is situated a little more to the northward, and an unsuccessful attempt to cross the ice-pack of Davis Strait, the ship returned home. On May 19 the land of Norway was sighted, the next day Cape Skagen was reached, and on May 21 the steamer arrived at Copenhagen.

SIXTEENTH ANNUAL REPORT OF THE BOARD OF HEALTH OF NEW HAVEN.

IN this report the efficient health-officer, Dr. S. W. Williston, presents in concise form the influences which have conspired to bring about a comparatively high death-rate in the city, — higher than in any year since 1881, though distinctly less than the average in the preceding years. This increase has been chiefly due to zymotic diseases, one-fourth of all the deaths being due to preventable causes. The mortality from diphtheria and membranous croup was nearly twice that of 1887; that from measles and diarrhoeal diseases was also high. From small-pox there were two deaths during the year. The history of these cases is both interesting and instructive, and emphasizes the necessity for a correct diagnosis in this disease. The first case was that of an engineer who contracted the disease in New York City. He had been vaccinated early in life, and thus escaped with varioloid, not more than thirty or forty pustules appearing on his body. His wife, attending him, was in due time taken with the same form of the disease. Both cases were treated for measles, both had had measles previously, and both had been vaccinated in childhood. The family living on the floor below, consisting of Mr. D., his wife, and child, had never been vaccinated, save Mr. D. The wife was first to contract the disease, having nursed the second patient. She died of confluent small-pox. The daughter, six years of age, contracted the disease from her mother, but so soon that vaccination after the recognition of the disease did not suffice to prevent its occurrence, of which she died. A middle-aged lady, a relative, called in to nurse Mrs. D., was vaccinated for the first time six days after exposure. The vaccination formed a typical pustule, but did not prevent the occurrence of the disease in a mild form. The disease was confined to the one house; and all those thrown in contact with the cases, who had been properly vaccinated, escaped. The two who had never been vaccinated died. One who was first effectively vaccinated six days after exposure, had it in a mild form. The two who had not been vaccinated since childhood had a light varioloid. In commenting on this case, Dr. Williston says, "And yet, I am sorry to say, in the light of such evidence, that has been so often repeated, there are physicians in New Haven to-day who do not believe in vaccination!"

The history of typhoid-fever in New Haven during the year is of special interest with reference to the localities in which this disease appeared. In recent years in Brooklyn this fever has seemed to be especially virulent in the better portions of the city, and to be practically absent from those sections in which the sanitary conditions are inferior; so much so, that it has become a popular impression in that city that typhoid-fever is a disease of the rich and well-to-do, and not of the poor. This was not true of New Haven

during 1888. Of the total cases, 210 in number, one-third occurred in the seventh ward, whose population is one-tenth of the entire city. Dr. Williston states that this ward is known to be in poor sanitary condition. The greatest factor in the mortality of the city was pulmonary consumption, which caused 217 deaths; next comes pneumonia, with 142. From infantile diarrhoea there were 137 deaths; from old age, 50; cancer, 40; and typhoid-fever, 38.

NOTES AND NEWS.

THE meeting of the Society of Microscopists will be held at Buffalo, N.Y., beginning on Aug. 21. Professor T. J. Burrill, Champaign, Ill., is the secretary.

— The peasant proprietors in Russia, says a writer in the *Nineteenth Century*, can neither pay the money owing to the government for their land, nor even the state and communal taxes, and are flogged by hundreds for non-payment. In one district of Novgorod, fifteen hundred peasants were thus condemned in 1887. Five hundred and fifty had already been flogged, when the inspector interceded for the remainder. Widespread famine is found over a great part of the country. Usurers, the bane of peasant proprietors in all countries, are in possession of the situation. The Koulaks and Jew "Mir-eaters" supply money on mortgage, then foreclose, and, when the land is in their possession, get the work done for nothing as interest. These bondage laborers, as they are called, are in fact slaves, and are nearly starved, while the small pieces of land are often re-united into considerable estates, and their new owners consider they have only rights, and no duties. Meantime, as forced labor is at an end, and free labor is of the worst possible kind, the old land-owners can get nothing done. They have tried to employ machines, bought by borrowing from the banks, and are now unable to repay the money. The upper class has been ruined, with no advantage to the peasant.

— The thirty-eighth meeting of the American Association for the Advancement of Science will be held at Toronto, Ont., beginning on Tuesday, Aug. 27, 1889, at noon, by a meeting of the council at the Queen's Hotel, where will be the hotel headquarters of the association. On Wednesday, Aug. 28, the first general session of the meeting will begin at ten o'clock in the forenoon in the Convocation Hall, University Buildings. After the adjournment of the general session, the several sections will organize. In the afternoon the vice-presidents will give their addresses before their respective sections; and in the evening there will be a general session, when the retiring president, Major J. W. Powell, will deliver his address. The sessions will continue until the Tuesday evening following, and on Wednesday morning, Sept. 4, a meeting of the council will be held. Saturday, Aug. 31, will be given to excursions. The meeting will close with excursions extending to Sept. 7. The general sessions and the meetings of the sections will be held in the University Buildings, where also will be the offices of the local committee and of the permanent secretary during the meeting. Board and lodging for members and their families may be had at moderate rates in several hotels and boarding-houses within easy reach of the place of meeting; and, as the local committee will provide a lunch, members will not be obliged to return to their lodgings during the heat of the day. In the evening, when not otherwise engaged, it is expected that the members of the association and of the local committee will meet socially in the reception-rooms at the hotel. A special circular in relation to railroads, hotels, excursions, and other matters, will be issued by the local committee, and members who are about changing their address for the summer should notify the local secretary at once. It can now be stated, however, that arrangements have been made by Mr. Dudley and the special committee on transportation by which members and their families will be, in general, able to obtain return tickets for one-third the regular rate, provided members are particular in complying with the conditions of the agreements with the passenger agents of the several railroad associations, which will be given in detail in the local committee circular. Without obtaining such a certificate as will be described in the local committee circular, to be countersigned at the meeting, the reduced rate for return ticket cannot be secured. For all matters pertain-

ing to membership, papers, and business of the association, address the permanent secretary at Salem, Mass., up to Aug. 22. From Aug. 22 until Sept. 9, his address will be A.A.A.S., Toronto, Ont. Members remitting back assessments before Aug. 22 will receive their receipts and volumes of "Proceedings" at once from Salem; those paying by mail after that date (and not present at Toronto) must not expect their receipts and volumes until after the meeting. The Cleveland volume of "Proceedings" will be sent during this month to all members who have paid the assessment for that meeting. The assessment receipt for the Toronto meeting must be shown at the time of registering, in order to obtain the association badge, which entitles the member to the privileges of the meeting. If members pay the assessment for the Toronto meeting in advance, and remember to take the assessment receipt to Toronto, they will save standing in the crowd before the secretary's desk, and can register at once on arrival after the opening of the register on Aug. 27. Under the rule which took effect in 1884, members have the privilege of registering members of their families (not including men over twenty-one years of age) by paying the sum of three dollars for each individual to be registered. These associate members will receive badges entitling them to all the privileges extended to members generally by the local committee. Special information relating to any of the sections will be furnished by their officers. Arrangements have been made for a discussion in Section B on the "Relative Merits of the Dynamometric and Magnetic Methods of obtaining Absolute Measurements of Electric Currents." Professor Thomas Gray of the Rose Polytechnic Institute will open the discussion with a paper on the subject, and he will exhibit one or more of Sir William Thomson's most recent forms of electric balance. Arrangements have been made by the local committee for the proper care and exhibition of instruments and specimens, for the details of which, and for all other local matters, members should address the local secretary. In anticipation of the circular to be issued by the local committee, it is only necessary here to give the names of Charles Carpmal, Esq., president of the committee; and of Professor James Loudon, local secretary, Toronto, Ont. Members of the association arriving in Toronto before the meeting should call for information at the temporary office of the local secretary, near the Union Railway Station.

— The Entomological Club of the American Association will meet at 9 A.M., Aug. 28, in the room of Section F, University Buildings, where members of the club will register, and obtain the club badge. Members of the club intending to contribute papers will send titles to the president, Mr. James Fletcher, Government Experimental Farms, Ottawa, Can. The Botanical Club will hold a meeting, as usual, on Tuesday, Aug. 27, in the room of Section F, University Buildings. Communications should be sent to the president, Professor T. J. Burrill, Champaign, Ill., or to the secretary, Douglas H. Campbell, 91 Alfred Street, Detroit, Mich. The Society for the Promotion of Agricultural Science will hold its tenth annual meeting in Toronto, beginning on Monday evening, Aug. 26, in the room assigned to Section I in the University Buildings, and continuing on Tuesday. For further information address Professor W. R. Lazenby, secretary, Ohio State University, Columbus, O. The American Geological Society will hold its meeting in Toronto on Aug. 28 and 29. Professor James Hall, Albany, N.Y., is the president; and Professor J. J. Stevenson, University of City of New York, secretary.

— Mr. Samuel Butler concludes a whimsical article in the May number of the *Universal Review* — an article which he hopes may give his readers absolutely no food whatever for reflection — with words which, though themselves whimsical, are not without their salt of truth, and might perhaps frustrate the very hope which he expresses. "I have sometimes thought," he says, "that, after all, the main use of a classical education consists in the check it gives to originality, and the way in which it prevents an inconvenient number of people from using their own eyes. That we will not be at the trouble of looking at things for ourselves if we can get any one to tell us what we ought to see, goes without saying; and it is the business of schools and universities to assist us in this respect. The theory of evolution teaches that any power not worked at

pretty high pressure will deteriorate; originality and freedom from affectation are all very well in their way, but we can easily have too much of them; and it is better that none should be either original or free from cant but those who insist on being so, no matter what hinderances obstruct, nor what incentives are offered them to see things through the regulation medium. To insist on seeing things for one's self is to be an *ἰδιώτης*, or, in plain English, an idiot; nor do I see any safer check against general vigor and clearness of thought, with consequent terseness of expression, than that provided by the curricula of our universities and schools of public instruction. If a young man, in spite of every effort to fit him with blinkers, will insist on getting rid of them, he must do so at his own risk. He will not be long in finding out his mistake." There is a fine flavor of "Hudibras" in this view of the case, which Mr. Sully might use as an example of heredity.

—The university delegates have decided, says the *Educational Times*, to arrange a second meeting of university extension and other students in Oxford in August next. The objects of the meeting are to stimulate and direct systematic home study by means of short courses of lectures, to supplement university extension teaching by a brief period of residence and study in Oxford, and to afford opportunities for conference between teachers and others interested in education on the best means of developing university extension and other educational work. The meeting will be divided into two parts. The arrangements for the first part, which will last ten days, will be similar to those which were successful last year. The second part of the meeting will consist of a supplementary period of three weeks' quiet study. The first part of the meeting will begin with an inaugural address by Professor Stuart, M.P., on Tuesday, July 30, and will end on Friday evening, Aug. 9. During the ten days there will be delivered on each morning, at 10.15, and at noon, short courses of lectures on history, literature, science, art, and political economy, and a number of evening lectures of a more general character. Among those who have already promised their assistance are Professor Max Müller, Professor S. R. Gardiner, Sir Robert Ball, Mrs. Fawcett, Rev. W. Hudson Shaw, Messrs. Arthur Sidgwick, R. G. Moulton, R. W. Macan, H. J. Mackinder, E. B. Poulton, D. S. M'Coll, F. Madan, etc. The second part of the meeting will begin on Saturday morning, Aug. 10, and end on Friday evening, Aug. 30. It is proposed that this period should be devoted to quiet study. Lectures will be delivered each morning at 9.45 and 11.45, and a class will be held after each lecture. The courses will be longer than those of Part I., and will deal in greater detail with the subjects then introduced.

—The strife between "Classics" and "Moderns" has assumed great proportions in Holland. Professor Naher of the University of Amsterdam has made the proposal that Greek should be removed from the curriculum of the gymnasia, and should only be compulsory for those who wish to study philology. It is to be noted that Herr Naher is a professor of classical philology. At present, every Dutch student, to obtain a certificate of maturity, must show proficiency in German, French, and English, as well as in Greek and Latin.

—The Michigan Legislature has just appropriated for the Michigan Mining School, \$104,000 for the furnishing and maintenance of the school during the years 1889 and 1890.

—The annual report of the Ohio Meteorological Bureau for 1888 shows that at the close of 1887, forty-seven observers were reporting to the bureau. Five of the number were officers of the United States Signal Service, and six were reporters of rainfall only. The number of stations now reporting is fifty-two. The work of the observers is entirely voluntary and without pay. It has been performed continuously and faithfully, as the tabulated results show. The distribution of weather telegrams, through the kindly interest of Gen. A. W. Greely, chief signal-officer at Washington, D.C., has been continued through the year. Of the thirty-six stations to which the telegrams were sent at the beginning of the year, seventeen were discontinued during the year, mainly because of the failure of display-men to properly display the predictions and report to the bureau. Seventeen new stations were added during the

year. These telegrams are furnished at government expense, the only conditions imposed being that the places receiving them should provide proper flags and arrange for their prompt display on receipt of the telegrams, and to report monthly on printed forms supplied for the purpose. The board of directors acknowledge their indebtedness to Gen. Greely for the encouragement and material aid which he has given in the prosecution of the work of the bureau. Without it, it would have been impossible to perform the work which has been done the past year with the funds set apart by the State for the purpose. In addition to the reports of current weather observations, a number of interesting and important special reports have been published in the monthly numbers through the year.

—Dr. George Owen Rees, F.R.S., died at Mayfield, Watford, Herts, on May 27. Dr. Rees took his degree of M.D. at Glasgow in 1837, and became a fellow of the Royal Society in 1843.

—We learn from *Nature* that the foundation-stone of the Framjee Dinshaw Petit Laboratory of Scientific Research, in Bombay, was laid on April 8 by Lord Reay. Mr. Petit, the son of the donor, explained that it had appeared to his father desirable, in the interests of medical education, that a laboratory for scientific research in biological and physical sciences should be established. He had long cherished the wish to have the properties of Indian drugs investigated, and made known to medical students. The laboratory will be connected with the Grant Medical College.

—Every one who takes the slightest interest in natural history will be sorry to learn that the kangaroo is in danger of being extinguished. Its skin is so valuable, says *Nature*, that large numbers of young kangaroos are killed; and high authorities are of opinion, that, unless the process is stopped, Australians will soon have seen the last specimen of this interesting animal. Mr. R. G. Salomon, one of the largest tanners in the United States, whither kangaroo-skin is chiefly sent, urges that a fine should be imposed for the killing of any kangaroo whose skin weighs less than ten-twelfths of a pound; and from a note on the subject in the *Zoologist*, by Mr. A. F. Robin of Adelaide, we are glad to see that a serious attempt is being made to secure the enforcement of this restriction throughout Australia and Tasmania, and the proclamation of a close season between Jan. 1 and May 1. We must hope that the Australian legislatures will understand the necessity of taking speedy action in this matter. It would be scandalous if, in deference to the wishes of a few greedy traders, they were to allow Australia to lose the most famous and most interesting of its characteristic fauna.

—A report was issued on Oct. 16, 1888, from the province of Santa Catharina, Brazil, on the newly introduced ramie-plant. The reporter, who is director of a colony called Grao Para, says that 1,000,000 plants are growing there of the sort called *Urtica utilis*, which is best qualified to resist cold, and able to survive frosts in the ground, without being pulled up and stored. It is not being propagated by seeds, but by transplanting its very numerous suckers, and putting them into the ground horizontally, so that they grow from each knot. They grow best in sandy soil, as in stiff wet soil the roots rot, but they must be strictly protected from wind. They are planted in August and September, and cropped as soon as they are six feet high, and are dark brown at the base. The colony, says the *Textile Recorder*, has a Delantsheer machine moved by water-power, which cost £120 on the spot. At the Concours International de la Ramie, on the Quay d'Orsay, this machine was stated to cost £40. This machine gives satisfactory but not very good results. The colony got the first prize, a gold medal, at Antwerp, for its ramie-fibres, and a manufacturer in the United States offered, without success, to supply machinery gratuitously to the colony in return for a monopoly of its produce of ramie. Commander Joaquim Caetano Pinto introduced the plant from Europe, and on Jan. 5, 1889, he signed a contract with the minister of agriculture by which he engages to import to the colony, at the public expense, two hundred more families of immigrants. The government also undertakes to help him by a donation of £3,000 for the first hundred families, and as soon as they have arrived, but not sooner, to begin making a road to the nearest railway-station on

the D. Thereza Christina line. It may be added that Brazil is peculiarly suitable for ramie, as here its uncontrollable tendency to spread would not give the considerable inconvenience which it does in older countries.

— The news comes from Madras that that portion of the world is ravaged both by famine and cholera. The province of Ganjam is where the epidemic has reached its greatest intensity. The official figures put the deaths at one thousand per week from cholera.

— During a discussion over the educational budget in the Belgium Senate recently, a member attracted attention to the constant increase in the number of students at the universities, — an increase which showed, in his opinion, that the examinations were too easy, and which threatened to overload the liberal professions.

— Since the end of the third week in May the water of the Seine has been distributed in two *arrondissements* of Paris. Usually this only happens during the hottest weather, towards the end of June or the early part of July. This year it will probably be necessary by that time to furnish the Seine water to a large part of Paris. The water is not considered especially healthful, and will attract the attention of visitors to the exposition by its yellow color.

— Sir John Bennett Lawes, the eminent agricultural scientist, of Rothamstead, has, it is stated, just completed arrangements for bequeathing to the cause of agricultural science the sum of £100,000, together with fifty acres of land and the laboratory and museum at Rothamstead. In the latter are stored more than 45,000 bottles of experimentally grown produce, of animal products and of soils. The income of the fund will be handed over to a committee of nine persons, including the owner of Rothamstead for the time being.

— Professor Dr. Foster, director of the University Ophthalmic Clinique at Breslau, has recently drawn the attention of parents and pedagogues to what he believes is often the cause of shortsightedness in the young; namely, that they are allowed to wear collars which are too tight for them. In three hundred cases that had come under his notice the patients were suffering from a chronic complaint brought on by a disturbance in the regular and normal flow of blood, caused by the wearing of collars which were not large enough.

— India, it would seem, is practically uneducated. The total number of scholars in schools and colleges of all sorts is only three and a quarter millions, or $1\frac{1}{4}$ per cent of the entire population. These are mainly confined to the cities and towns; and out of 250,000,000 in all India, less than 11,000,000 can read and write. A census of the illiterates in the various countries of the world, recently published in the *Statistische Monatsschrift*, places the three Slavic states of Roumania, Servia, and Russia at the head of the list, with about 80 per cent of the population unable to read and write. Of the Latin-speaking races, Spain heads the list with 63 per cent, followed by Italy with 48 per cent, France and Belgium having about 15 per cent. The illiterates in Hungary number 43 per cent, in Austria 39, and in Ireland 21. In England we find 13 per cent, Holland 10 per cent, United States (white population) 8 per cent, and Scotland 7 per cent, unable to read and write. When we come to the purely Teutonic states, we find a marked reduction in the percentage of illiterates. The highest is in Switzerland, 2.5; in the whole German Empire it is 1 per cent; in Sweden, Denmark, Bavaria, Baden, and Württemberg, there is practically no one who cannot read and write.

— The problem of separating the mica in the tin ores by a simple and effective process is claimed to have been solved by Professor Carpenter of Dakota. If this should be true, says *The Engineering and Mining Journal*, and the deposits in the Black Hills prove anything like as extensive as they have been represented, it ought to aid the establishment of a vast tin-plate industry to compete with the foreign producers.

— The success of the petroleum borings in Galicia would lead us to expect, according to *The Engineering and Mining Journal*, that the Austro-Hungarian Empire will be totally independent of a foreign supply of oil. Formerly there was a tendency to speak

slightly of Galician oil-deposits, owing to the fact that a large proportion of the wells were dug by hand. Of late years the American method of drilling has been introduced, and many Galicians have become accomplished drillers. In the Lodyna district, wells of a profitable character have been bored. Galician wells have not the copiousness of Russian; but a readier market exists for the oil, and the demand for Lodyna petroleum is such that it is sold at a high rate long in advance of appearing on the surface. The oil-belt of Lodyna is five miles long, and intersected by a railway, thereby enabling the oil to be sent to the refineries at a trifling expense. A few years ago all the refineries in Galicia did not produce 1,000,000 gallons of refined oil, but now their production exceeds 6,000,000 gallons. The Austrian Government takes great interest in the development of the petroleum industry, and has adopted a protective policy which has already succeeded in establishing the Galician oil-trade on a firm basis. In consequence of this and of such successes as the recent borings at Lodyna, where wells have been struck giving a profit of 500 or 600 per cent, the financial and commercial world in Austria has been deeply moved, and petroleum has caused much excitement.

— *Forest and Garden* states that important rose-shows in England this summer will be held as follows: July 2, Boston, Sutton; July 10 and 11, Brighton, Ealing; July 17, Bedford; July 26 and 27, Wilmslow.

— James K. Reeve, in *The Chautauquan* for July, makes some very practical suggestions regarding perfume flower-farming. He says, "The Hon. Norman J. Coleman, late commissioner of agriculture of the United States, in a recent personal letter to the writer of this paper, stated that in his opinion there is in this country, undoubtedly, a vast and undeveloped field suitable for the culture of perfume-yielding plants and flowers, notably on the borders of the Gulf of Mexico, and expressed the belief that the commercial floriculture of this region may yet rival the production of the Mediterranean coast, and become not only the great flower-garden of America, but of the world. A leading perfumer of New York tells me that experiments in perfume flower-culture have been made in most of our Southern States, and that domestic pomades have been frequently offered to dealers, but not of a quality sufficiently good to warrant their use. They attribute this to ignorance of the conditions necessary to the proper production of the pomades, and not to any lacking element in our floriculture. As a home industry in which the surplus labor of a household could be profitably employed, there is nothing which seems at once so practicable and pleasing as this. When flowers are introduced into our gardens as a commercial factor, the gardens will receive more of the time and attention of that portion of our households who most need the out-door life, the strength and color, the health and happiness, that may be found in them.

— The site for the zoölogical garden in Washington has been selected. It comprises about one hundred and fifty acres to the north-west of the city, about two miles from the White House, along the banks of Rock Creek, and is said to be in every way well adapted for its purpose. Before next winter the necessary arrangements will probably be so far advanced that the animals now housed in the grounds of the Smithsonian Institution can be removed to their new quarters.

— Professor Patrick of the Iowa Agricultural College, says *Garden and Forest*, undertook last winter to make a chemical study of apple-twigs to ascertain whether he could detect differences of composition between the young growth of such varieties as are hardy and those which are not hardy in that region. At the same time and for the same purpose a microscopic examination was made of apple-twigs by Dr. Halsted. It would be a great advantage if hardy and tender varieties could be distinguished from each other by a chemical analysis or an examination of their cell-structure. Professor Budd, indeed, has expressed the opinion that there was an apparent difference in the structure and composition of the trees which proved hardy in Iowa and those which were tender. The results of Professor Patrick's analysis "lend, perhaps, some slight encouragement" to this idea. Professor Halsted found "no parallelism between microscopic structural differences and ability to withstand the influences of a trying climate."

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PROFESSOR WÄTZOLDT, the director of the Elisabethschule (a girls' school in Germany), has addressed a most serious warning to parents and guardians on one of the evils of the present system of teaching girls. It is on the subject of what Wagner has contemptuously called *Hammermusik*. The professor begins by pointing out that the terms "musician" and "pianoforte-player" are not at all convertible. Then he refers to the illogical conduct of so many parents, who, for the sake of their children's health, ask them to be excused certain subjects of the school course, while they encourage them in the most excessive exertions at the pianoforte. Now, there is no subject which, if taught seriously, makes such a demand upon the store of nervous energy of the body as instrumental music. The brain, the eye, and the hands are all exercised at once: hence the frequent injury to health in the case of girls who have not a strong constitution. The professor has collected some statistics which show that more than half the pupils are taught the pianoforte, and that after their tenth year they spend twice as much time daily at it as at their other home lessons. Many girls complain of feeling tired, absent-minded, fidgety, of headaches and sleeplessness; and these complaints grow worse as they grow older. In all cases where the parents could be prevailed upon to diminish the hours of pianoforte practice, or stop it altogether, a marked improvement in general health was the invariable result. Herr

Wätzoldt, therefore, recommends (1) that pianoforte instruction, should not begin until the age of twelve; (2) that only girls of sound health, and who show some talent for music, should be made to play. We also agree with the final observations of the professor, who must be a true lover of genuine music. "It is an indubitable fact," he says, "that nine-tenths of the girls, after years of arduous practice, only attain to a certain automatic technique, which not only has no relationship with art, but is an actual hindrance to true musical perception. Teachers and medical men should do all in their power to stop this pianoforte strumming, which kills all true feeling for art, and renders a normal bodily development impossible. We know how difficult it is to fight against the fashions and vanities of the day; but, if it is only shouted from the house-tops that true art and culture have nothing whatever to do with mediocre *Klavierhammern*, there will be some, at least, in the maddening crowd that will pause and reflect; and these, by a lucky chance, sometimes become leaders who set a better fashion to the unreflecting masses."

PULMONARY CONSUMPTION IS MORE TO BE FEARED in every community than any other disease that affects mankind. Cholera, yellow-fever, and small-pox — diseases that paralyze with fright entire countries — are exceedingly limited in their results, in comparison with the slaughter of consumption. Last year Florida was panic-stricken from the havoc of yellow-fever; but during the same year consumption destroyed more than twice as many lives in the little State of New Hampshire, and not a tremor ran through the body corporate. The average annual death-rate in this country, from cholera, yellow-fever, small-pox, typhoid-fever, diphtheria, and scarlet-fever, all combined, does not reach the enormous total of deaths from consumption. It is time that some determined and systematic effort be made to lessen this disease which is now regarded by so many as preventable. Among the general sources of infection there is one, at least, that should be removed, or, if not wholly removed, greatly lessened by legal action, and that is the sale of tuberculous food-products. Such foods, chiefly in the form of tuberculous meat and milk, particularly the latter, are undoubtedly extensively sold to unsuspecting consumers; and that the results are not infrequently lamentable, no sanitarian doubts. The general government has taken no measures to restrict this abuse, nor have the individual States. To illustrate: the New Hampshire State Board of Health says that very recently complaint was made to the Board of Cattle Commissioners that some disease existed in a herd of thirty cows in a certain town of the State; and, under the assumption that the disease might be pleuro-pneumonia, the government, upon notification, sent a competent veterinary surgeon to inspect the herd. The inspector immediately diagnosed tuberculosis, had an infected cow killed, and the post-mortem examination revealed tubercles in nearly every organ of the body, including the udder. The inspector reported that about seventy-five per cent of the herd was already infected. All, or nearly all, the cows were being milked, and the product being sold daily to a milk-dealer for distribution among his customers. The dairyman, ignorant of the character of the disease, was bringing up a baby upon the milk of a single cow in which the disease had advanced nearly to its fatal termination. Under the laws of New Hampshire, neither the Board of Cattle Commissioners nor the State Board of Health has any authority to deal with tuberculosis in cattle in a way necessary to restrict its spread among other herds, or to prevent the dangers to which it subjects the human family.

THERE ARE CONNECTED with the public-school system of Cincinnati, classes for the instruction of deaf-mutes. Two of these classes receive their education through the well-known methods of signs or finger-movements; while at the Sixth District School on Elm Street, above Fifteenth Street, there is a separate school of

some thirty pupils, who are being taught to readily understand every thing said to them by watching the movements of the speaker's lips, and are themselves in turn taught to speak and read aloud through the oral method. This class of scholars was organized some three years ago, and resulted in the formation of a society for the improved instruction of deaf-mutes. About one year ago the society succeeded in having provision made whereby the classes should form part of the public-school system. There should be better provision made, however, for the development of this branch of the public-school system. More room is needed for the pupils; additional instructors are required; and, beyond any question of dispute, this work, so well begun by private subscription, should be fostered and cared for out of the school fund. There are now being made efforts to have schools located in different parts of the State, and at the next session of the Legislature there will be presented a bill in which the State will be expected to pay for the education of all deaf-mute citizens of the State by this oral method.

DANGER LURKING IN DECOMPOSING ANIMAL OR VEGETABLE FOOD.¹

MUSCARINE as a product of putrefaction has already been alluded to by me in my last report for the chemical department of the Agricultural College, and in foreign scientific journals, where the case has attracted some attention as furnishing facts previously unknown. My connection with the occurrences reported originated through the death of four persons from the consuming of fish-containing-food in a slightly putrid condition; and my analysis of the food was undertaken at the solicitation of the police department of the Hokkaidō Chō.

Two adults and two children living in Chitose died suddenly with symptoms of narcotic poisoning. Post-mortem examination, however, failed to satisfactorily account for death; but the appearance of the organs, together with the ante-mortem symptoms, were considered by the officiating physicians to resemble poisoning from the poisonous mushroom (*Agaricus muscarine*).

Specimens of the food eaten by the deceased were therefore sent me for chemical examination. The articles received were two; namely, a variety of edible mushroom, and a native food called "*sushi*," consisting of a mixture of fish and rice with a little *saké*, which is allowed to ferment and become vinegar before the mixture is eaten. The fish was *gnoi*, one of the most common and wholesome of Japanese river-fish. In the former of the two substances subjected to examination, no trace of alkaloid or other injurious substance could be detected. The "*sushi*," however, reached me in an advance stage of putrefaction. (This food is usually eaten in a condition decidedly "strong.") I was therefore compelled to recognize the uselessness of attempting the elimination or recognition of alkaloids by the usual methods of procedure, and to admit the extreme probability of the presence of some ptomaine as a product of decomposition. The methods pursued and the results obtained may possibly require a brief introduction, that the facts involved may be the better recognized. Only the briefest possible *résumé* of the facts necessary for a better consideration of the questions involved is here admissible. The relations between alkaloids and albuminoids are known to be most intimate. The latter, acted on by certain micro-organisms, undergo a decomposition known as putrefaction, and the life-function of certain of these organisms results in the conversion of albuminoids into alkaloids; this latter group of compounds consisting chiefly of poisonous substances, until recently supposed to be exclusively of vegetable origin. Though numerous instances of poisoning through the consumption of food undergoing the process of putrefaction are recorded, and as long ago as 1822 Garpert and Stick made known the existence of a specific poison in decomposed animal matter, it was not till 1877 that really definite knowledge was evolved from the facts accumulated. The Italian chemist Selmi then first isolated a basic compound, of alkaloid character and toxic properties, of unmistakable putrefactive origin, and named by the discoverer "*cadaves alkaloid*," or "ptomaine."

In 1880 the Italian minister of justice appointed a commission of chemists and pharmacists to investigate the entire field thus opened, and formulate the facts gathered. The work thus begun has been continued by the investigators of different countries, until there are now known and isolated not less than twelve of these alkaloids of putrefaction, seven of which have been made known through the labors of Dr. Brieger of Berlin since 1883. It is chiefly to this investigator that we are indebted for the enunciation of reliable methods of elimination and recognition.

The method adopted by me in the investigation undertaken was in most respects identical with that recommended by Brieger, the modifications being only such as were suggested by the somewhat peculiar nature of the substance and the circumstances demanding the examination; the ptomaines thus far eliminated being for the most part insoluble in ether, while the latter removes large quantities of organic matter, the presence of which renders subsequent purification more difficult. I first subjected the mass to one hour's extraction with warm ether in an automatic extraction apparatus of my own device. The extract thus obtained was set aside for future examination; and the residue, slightly dried, and free from fats and other ether-extracted matter, was heated with water acidulated with hydrochloric acid for two hours, the temperature being kept below 100° C. The solution thus obtained was evaporated to a thick sirup over the water-bath, an acid re-action being carefully maintained, and the residue extracted several times with absolute alcohol, until the addition of alcohol failed to precipitate more nitrogenous matter. The fluid solution was then evaporated to dryness, the residue taken up in 90 per cent alcohol filtered and precipitated with platinic chloride. The precipitate thus formed was then treated with an excess of water; the alkaloid-platinum double salt, if present, going into solution, from which the insoluble platinum compound was separated by filtration. The solution was next subjected to a stream of hydrogen sulphide till all platinum was precipitated, the solution being then neutralized by sodium carbonate, and evaporated to dryness. This residue was repeatedly washed with absolute alcohol, and the solution obtained evaporated to dryness over the water-bath and then taken up in water. This solution should now contain the pure hydrochloride salt of any alkaloid extracted from the original substance by the acidulated water.

Allowed to slowly evaporate over sulphuric acid, fine laminar opaque crystals were formed, which were found to be soluble in alcohol and in water, but insoluble in ether. The aqueous solution gave with phospho-molybdic acid and with mercuric-potassium iodide amorphous precipitates. Mercuric chloride produced a white amorphous precipitate, crystallizing after some time. With gold chloride, a bronze-colored non-crystalline precipitate was obtained.

Platinum bichloride yielded a fine slightly crystalline precipitate of great insolubility. Excess of bromine-water produced a reddish-brown precipitate, soon disappearing.

The identity of the compound with muscarine, the poisonous constituent of the "toadstool," seems to be thus established, and is further confirmed by the evidence of the post-mortem on the victims of the consumption of the food from which the alkaloid was isolated. The official report of the examining physicians mentioned muscarine symptoms. No mushrooms were, however, found in the stomachs, though, because of the symptoms, some were furnished me for analysis. The further confirmation of elemental analysis has not yet been possible, since the total amount recovered was not more than sufficient for analysis: it was therefore deemed inexpedient to resort to the destruction of what might, under the circumstances, be required as evidence. A combustion analysis will, however, ultimately be made, and the results recorded. The ether extract made before the treatment with acidulated water, was subsequently found to contain an alkaloid yielding white crystals over sulphuric acid, and a crystalline precipitate with gold chloride. I have as yet, however, been unable to establish the identity of this compound, and therefore reserve further details, together with results of efforts to "cultivate" these products of decomposition at will, for some subsequent report.

Muscarine, so far as I am able to ascertain, has not heretofore been recorded among the ptomaines isolated and named, although

¹ Report by H. E. Stockbridge, Ph.D., of the Government Agricultural College, Sapporo, Japan.

its existence as a product of putrefaction has been suspected; and Brieger speaks of the "*muscarin äuliche Wirkung*" of an alkaloid isolated by him, but is not satisfied of its identity, as this alkaloid is not included in the list of those discovered and recorded by him.

The case I have here reported is, moreover, doubtless the only one yet investigated wherein muscarine, heretofore known only as a vegetable alkaloid, has been found as a decomposition-product in a food the consumption of which has resulted in death, attended by the well-known symptoms of muscarine-poisoning. The facts observed and here recorded seem to present one more illustration of the intimacy existing between the composition and decomposition of animal and vegetable organisms, and furnish an additional proof of the interest and importance of this new field of investigation. Interest in the researches made in this new domain must be proportional to their importance, capable as they are of developing facts of so universal significance, and dealing with transformations occurring not only in the food we may eat, but in any animal body as well, and demanding new methods of lego-chemical investigation.

During the past year I have continued the investigation begun the previous season, and am now able to report the repeated isolation of muscarine as a product of the putrefaction of the food from the eating of which the four people at Chitose died, and, moreover, have been so fortunate as to discover two new and heretofore unknown ptomaines. One of these was obtained from the original ether extract; but, though their character has been carefully studied, I prefer to reserve opinion as to identification.

Discussion of the scientific interest and value of these facts is here out of place; but their practical value is, however, of widespread importance and applicability, both from sanitary and legal points of view. We are forced to recognize the danger of eating either animal or vegetable food after decomposition has begun, since this process may result in the development of deadly poisonous alkaloids resembling in physiological properties, strychnine, morphine, brucine, and other of the most powerful poisonous alkaloids hitherto known only as products of vegetable growth. Many diseases of a cholera-like character, perhaps even this most dreaded malady itself, may result from the consumption of food in which the process of putrefaction has begun. From a legal standpoint, chemists, physicians, and jurists are now compelled to recognize the possibility that many supposed cases of criminal poisoning are in reality the result of ptomaine-formation, either in food or in the decomposing body after death.

BOOK-REVIEWS.

Fundamental Problems. By DR. PAUL CARUS. Chicago, Open Court Publ. Co. 12°. \$1.

THE author of this work is the editor of the *Open Court*, a paper professing to teach a new religion, and most of the chapters of which the book consists have already appeared in the columns of that paper. The object of the book is to set forth the philosophy of Dr. Carus, which, we suppose, must be taken as the basis of that improved religion which the *Open Court* was founded to teach. One merit the work certainly has: it is, except in the ethical part, plainly written, and leaves no doubt as to what the author's philosophy is. It is a crude and crass materialism. Indeed, we have never seen a work in which the materialistic view was presented in so extreme a form as in this of Dr. Carus. Thus, in discussing the origin of feeling, he says, "We must expect the solution of this problem from biological investigations. . . . The conditions of feeling must exist in the inorganic matter of our world, and the appearance of the phenomena of sensation will be found to depend upon a special form in which the molecules of protoplasm combine and disintegrate" (pp. 10-11). And elsewhere he says that "it is not improbable that feeling will be demonstrated as a special kind of reflex action in organized substance" (p. 185). "The ego . . . is the result of the innumerable and complicated nerve organisms in our body" (p. 214). And then, as if these assertions were not sufficient, Dr. Carus declares "it is undeniable that immaterial realities cannot exist. The thing exists by its being material" (p.

86). He ridicules the idea of a First Cause, even when conceived as the Unknowable, and calls it a chimerical nonentity. God is variously spoken of as the All-existence and as the order of the world. The doctor's ethical theory is confused and inconsistent. He rejects utilitarianism, and at first adopts Kant's view that the moral law is purely formal, without any reference to ends; yet again he says that man is moral "by observing and conforming to the cosmical order of nature;" and both these views are supplemented by the theory that morality consists in living for the ideal, though what the ideal is we are nowhere informed. Such are Dr. Carus's views; and we are constrained to say that we do not think they will revolutionize either philosophy or religion.

Hygiene of the Nursery. By LOUIS STARR. 2d ed. Philadelphia, Blakiston. 12°. \$1.

WHEN the first edition of this manual appeared, we said, that, of the many books which have been published on this subject, this was by far the best. This, the second edition, is, by virtue of a thorough revision and numerous additions, superior to the first. It has our hearty commendation.

Statics for Beginners. By JOHN GREAVES. London and New York, Macmillan. 16°. 90 cents.

THIS work on "Statics for Beginners," by John Greaves, fellow and mathematical lecturer of Christ College, Cambridge, England, assumes no knowledge beyond "Euclid," Books 1-6, and elementary algebra, with a few propositions in trigonometry. Collections of easy examples are inserted after the more important propositions, while examples of greater difficulty are given at the ends of the chapters.

AMONG THE PUBLISHERS.

MESSRS. GINN & Co. announce as in preparation "Practical Latin Composition," by W. C. Collar, A.M., head master of the Roxbury Latin School, Boston, and author of "The Beginner's Latin Book" and "Collar's Eysenbach." This book embodies a method that has been followed by the author for many years with the most satisfactory results. A brief explanation of the method will show how rational it is, how well it accords with the principles of language-teaching now most approved, and how simple and effectual an aid it should prove to a real understanding of Latin. The book consists of three classes of exercises, all based on selections from the Latin authors usually read in schools. The first exercise of each group contains easy sentences to be turned into Latin orally, — sentences involving the use of words, idioms, and constructions of the Latin text assigned for study in preparation. The second exercise consists of a short passage of continuous English to be written out in Latin, based on the same Latin text as the preceding. The third exercise, which may be omitted at the teacher's option, contains questions in Latin, to be answered in Latin, on the subject-matter of the original, but not introducing either words or grammatical principles that are unfamiliar. Notes and occasional grammatical references accompany the exercises.

— "From Nineveh to the Lake; the Deluged Valley of the Conemaugh; Scenes Afoot," is announced by Alex. Y. Lee, architect and civil engineer, 96 4th Avenue, Pittsburgh, Penn. This is an extended bird's-eye view of the valley of the Conemaugh, Johnstown, and the lake, finely lithographed and drawn from personal sketches, and based upon surveys of the Pennsylvania Railroad.

— Roberts Brothers have just ready, in their series of Balzac's works, "Seraphita," which is the completing volume of Balzac's three philosophical novels, of which "The Magic Skin" and "Louis Lambert" have already been issued by this house. Many critics have so little understood the real meaning of "Louis Lambert" and "Seraphita," that they have wondered why the author gave them a place in the *Comédie Humaine*, which, nevertheless, without them, would be a temple without a pediment, as M. Taine very clearly saw and said. Mr. George F. Parsons takes advantage of Miss Wormeley's translation to state and prove and elucidate this truth in an introduction, and all serious readers who follow it throughout will never regret that they have thus prepared themselves to understand Balzac's work.

— Barnicott & Son, Taunton, England, have issued another edition of their useful "Country Gentleman's Reference Catalogue to the Best Works on Agriculture, Botany, Natural History, Sporting, Recreations, Domestic Management, and Kindred Subjects."

— Sir Morell Mackenzie, in the *Contemporary Review*, in writing of stimulants and the voice, says, "Tobacco, alcohol, and fiery condiments of all kinds are best avoided by those who have to speak much, or at least they should be used in strict moderation. I feel bound to warn speakers addicted to the 'herb nicotian' against cigarettes. Like tipping, the effect of cigarette-smoking is cumulative, and the slight but constant absorption of tobacco juice and smoke makes the practice far more noxious, in the long-run, than any other form of smoking. Our forefathers, who used regularly to end their evenings under the table, seem to have suffered little of the well-known effects of alcohol on the nerves; while the modern tippler, who is never intoxicated, is a being whose whole nervous system may be said to be in a state of chronic inflammation. In like manner cigarette-smokers (those, at least, who inhale the smoke, and do not merely puff it 'from the lips outward,' as Carlyle would say) are often in a state of chronic narcotic poisoning. The

old jest about the slowness of the poison may seem applicable here; but, though the process may be slow, there can be little doubt that it is sure. Even if it does not kill the body, it too often kills or greatly impairs the victim's working efficiency and usefulness in life. The local effects of cigarettes in the mouth must also be taken into account by those whose work lies in the direction of public speech. The white spots on the tongue and insides of the cheeks, known as 'smoker's patches,' are believed by some doctors with special experience to be more common in devotees of the cigarette than in other smokers. This unhealthy condition of the mouth may not only make speaking troublesome, or even painful, but it is now proved to be a predisposing cause of cancer. All fiery or pungent foods, condiments, or drinks tend to cause congestion of the throat; and, if this condition becomes chronic, it may lead to impairment, if not complete loss, of voice. The supposed miraculous virtues of the mysterious possets and draughts on which some orators pin their faith exists mainly in the imagination of those who use them: at best, they do nothing more than lubricate the joints of the vocal machine, so as to make it work more smoothly."

**Publications received at Editor's Office,
June 10-15.**

BALZAC, H. de. *Seraphita*. Tr. by Katharine Prescott Wormeley. Boston, Roberts. 275 p. \$1.50.
COCKSHOTT, A., and Walters, F. B. *A Treatise on Geometrical Conics*. London and New York, Macmillan. 205 p. 12°. \$1.25.
CRANE, T. F. *La Société française au Dix-Septième Siècle*. London and New York, Putnam. 342 p. 24°. \$1.50.
HELPS, A. *Essays written in the Intervals of Business*. London and New York, Macmillan. 130 p. 16°. 60 cents.
PAUL, H. *Principles of the History of Language*. Tr. by H. A. Strong. New York, Macmillan. 512 p. 8°. \$3.

WALLACE, A. R. *Darwinism: an Exposition of the Theory of Natural Selection with Some of its Applications*. London and New York, Macmillan. 494 p. 12°. \$1.75.

WRIGHT, G. F. *The Ice Age in North America and its Bearings upon the Antiquity of Man*. New York, Appleton. 622 p. 8°. \$5.

FOR SALE.

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CONTENTS FOR JUNE 1889.

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— A new magazine idea has been struck by *Scribner's*, the July issue of which will be a fiction number for midsummer reading, containing seven complete short stories, bright, entertaining, and richly illustrated by skilful artists like Frederic Remington, Robert Blum, and Chester Loomis. The number will also contain the ninth instalment of Mr. Stevenson's "Master of Ballantrae," and the second article in the electric series. This last is by Charles L. Buckingham, the electrical expert and attorney for the Western Union, and is on "The Telegraph of To-day." This will be abundantly illustrated with views from the great operating-room of the Western Union in New York, from the main office of the Commercial Cable Company, and from other interesting sources. Telegraphing from moving trains and between ships at sea will be clearly explained.

— Messrs. Ginn & Co. announce for publication "A School Iliad, with Vocabulary," edited for schools by Professor T. D. Seymour of Yale College, author of "The Language and Verse of Homer," etc., with introduction, commentary, and illustrated vocabulary. Two editions will be published, — the first consisting of three books, to be ready June 20; and the second, of six books, to be ready some time this summer. The introduction presents, in brief but systematic form, the most important facts regarding Homeric life, the Homeric poems, Homeric style, syntax, dialect, and verse. The commentary is adapted to the wants of beginners in Homer. The notes are copious for the first three books. They are less copious for Books IV.–VI., but the commentary on Book VI. is fuller than that on Books IV. and V. The vocabulary is illustrated with more than twenty woodcuts, most of which are new in this country.

— Frederick Warne & Co. have now ready "Fifty Years on the Trail," a true story of Western life, by John Y. Nelson and Harrington O'Reilly, illustrated by Paul Frenzeny, who has also lived among the scenes in which this story of wild frontier life is laid. Nelson was an old-time scout, guide, and interpreter before cities and towns drove out Indians and buffaloes, and with the aid of his collaborator he has made a book of four hundred pages, which appears with appropriate cover-design.

— T. Y. Crowell & Co. publish the following important books, in paper covers, at fifty cents each, this month: "Ivan Ilyitch and Family Happiness" and "My Confession," two contrasting works by Count Lyof N. Tolstoy; and Dr. George Brandes' new book, "Impressions of Russia," which will throw fresh light on a very interesting subject.

— D. C. Heath & Co. will publish in September "A German Reader, for Beginners in School or College," by Edward S. Joynes, editor of the "Joynes-Meissner German Grammar."

— The Cambridge University Press, according to the *London Academy*, has now nearly ready for publication "The Collected Papers of Henry Bradshaw," the late university librarian, and a wonderful scholar.

— Roberts Brothers announce for fall publication "The Life of Louisa M. Alcott," by Ednah D. Cheney, her lifelong friend. Miss Cheney has written her biography of the author of "Little Women" in a manner to interest the youngest readers of that wonderfully successful book, who will eagerly read the story of Miss Alcott's home life, and her efforts to write stories for the boys and girls she loved so dearly. Two portraits will be included in the book.

— The July number of *The Chautauquan* presents as its opening article a study by Gen. H. V. Boynton on "Our National University," the city of Washington. Elizabeth Robins Pennell gives some advice about "Outings for Thin Pocket-Books." The "Sunday Readings" are selected by Bishop Vincent. Professor La-Roy F. Griffin of Lake Forest University furnishes a timely article on "The Art of Keeping Cool." Ida M. Tarbell sketches the life of Madame de Staël. A brief description of "Student Life in Germany" is given by F. M. Warren, Ph.D. Olive Thorne Miller continues her observations of bird-life, this time writing of their "Baby-Days." Professor A. P. Coleman, Ph.D., of Victoria University, relates some thrilling experiences of his while canoeing on the Columbia. "The Foreign Element and Prohibition" is the subject of a thoughtful article by the Hon. Albert Griffin, chairman

of the Anti-Saloon Republican National Committee. Bishop Mal-lalieu tells of his sight-seeing in holy Moscow. John Murdoch describes "Hunting and Fishing at Point Barrow." James K. Reeve suggests perfume flower-farming as "a home industry in which the surplus labor of a household could be profitably employed." "Chautauqua Life in 1800" is a valuable historical article by Francis Newton Thorpe, Ph.D. Ripley Hitchcock gives a delightful account of "Country Club Life," and interesting facts regarding "The Jews in the United States" are given by Philip Cowen.

— A. D. F. Randolph & Co. will publish at once "Unknown Switzerland," by Victor Tissot, translated by Mrs. Wilson.

— The *Contemporary Review* for June (New York, Leonard Scott Publication Company, 29 Park Row) opens with a paper by Archbishop Walsh, entitled "Arbitration or the Battering-Ram?" in which he relates some of the leading incidents that have marked the course of his efforts in the cause of peace. The archbishop is an ardent advocate of the efficacy of arbitration, and he describes the progress made thus far by that method in settling the Irish question. Sir Morell Mackenzie contributes the first of two papers on speech and song, which, in view of the author's connection with the late Emperor Frederick, promise to possess exceptional interest. W. T. Stead, editor of the *Pall Mall Gazette*, contributes an article on "Madame France and her General," in which he treats of the rise, progress, and possible future of Boulanger. France, he argues, is wearied of the republic, and Boulanger is simply a distraction. The republic has committed many grave and glaring faults, especially the policy of colonial extension; the administration has been tainted with corruption; the government is intensely anti-clerical; and stupendous financial crises have happened under it. Frederick Greenwood traces the decline of English influence in continental politics in a paper entitled "The Mysteries of our Foreign Relations." Vernon Lee presents some irrelevant talks on the use of the beautiful, in a paper entitled "Orpheus in Rome." Edwin Hatch argues that the tendency of the present age has been to transfer the basis of theology from metaphysics to history. E. J. Goodman describes that well-known English institution the Savage Club, and tells some interesting stories in connection with it. G. B. Hill presents a somewhat novel view of Dr. Johnson's character in an article on "Dr. Johnson as a Radical." Sir William Dawson contributes a brief note, in which he defends himself on some of his views of Genesis. The number concludes with two papers on "The Volunteers," by C. B. Brackenbury and Lord Mayor Whitehead.

— The *Nineteenth Century* for June (New York, Leonard Scott Publication Company, 29 Park Row) opens with an appeal against woman suffrage, signed by a number of representative English women, including such names as Lady Frederick Cavendish, Lady Randolph Churchill, Mrs. Knox-Little, Mrs. Humphry Ward, Mrs. Huxley, Mrs. Lynn Linton, Mrs. Alma Tadema, Mrs. Matthew Arnold, and Mrs. Max Müller. Professor Edward Dicey presents a short but strong article on the "Ethics of Political Lying." Mlle. Blaze de Bury contributes the first of two papers on the "Theatre Français and its Sociétaires," in which she traces the continuity of common interests which has kept this body together for two centuries, and explains Molière's ideas in creating it. In an article on "A Bird's-Eye View of India," Lady Grant Duff argues that India is a continent, not a people, and that its real characteristics are practically unknown in England. Lady Verney writes on "Six Generations of Czars," summarizing the personal history of the czars for the last two hundred years, and deducing therefrom the personal traits of the present ruler. Prince Krapotkin writes on the "Great French Revolution," which he regards as a necessity and the greatest moving force in modern history. He argues that the condition of the Russian peasantry to-day, compared with that of the French, is sufficient proof of the benefits wrought by the revolution. Mrs. Priestly writes on the "Mysteries of Malaria," reviewing the recent progress made in analyzing the disease. Edward Clifford, whose paper on "Father Damien and the Lepers" last month attracted so much attention, contributes an article on the "Hawaiians and Father Damien." Samuel Plimsoll presents some interesting facts on marine insurance, in an article which is a continuance of papers on the same subject in the March and April

numbers of the *Review*. The Rev. H. P. Dunster argues for an extension of the postal service, in a paper entitled "An Agricultural Parcels Post," in which he maintains that the post-office should give facilities for the distribution of food. E. N. Buxton contributes an eminently readable article on "Sardinia and its Wild Sheep," descriptive of a hunt in the wilds of Sardinia. Lord Ebrington describes a "By-Election in 1747," giving the full details of the expenses of parliamentary methods more than one hundred years ago, and throwing much light on early politics. The number concludes with a long essay by Professor Huxley on "Agnosticism and Christianity," written in his most characteristic vein, which forms an important contribution to the already extensive list of papers on this subject published in this *Review*.

—Messrs. Longmans, Green, & Co. send us the first number of the *New Review*, a magazine of ninety-six pages, which is sold for the low price of fifteen cents. The prospectus lays great stress on the eminence of the contributors that have been engaged, and conveys possibly the impression that the writer's name will be considered of more account than the quality of his work. However, the articles in this first issue are on the same level as those of its larger rivals, though some of them are too brief for a proper presentment of the subject treated. The opening paper, on "Gen. Boulanger," is the best, and will of course attract the most attention. It is in two parts. The first, written with the general's own authority and presenting his side of the case, is by Alfred Naquet of the French Senate; the second, presenting the opposite side, by Camille Pelletan of the French Chamber. It appears that the general's followers are animated by dislike of parliamentary government, and, though professing to be republicans, they really want a sort of dictatorship tempered by the *plébiscite*. French parliamentarism has not been so successful as might be wished, owing to the fact that the ministry are not at liberty to dissolve the Chamber and appeal to the people; but to seek a remedy, as M. Naquet would do, in the virtual abolition of parliamentary government, seems very unwise. M. Pelletan thinks the rise of Boulangerism an almost unaccountable phenomenon, but attributes it partly to the discontent which various classes feel towards the present government, and partly to the passion of the French people for a hero. It is plain, from the tone of the two articles, that the general's partisans are more hopeful than his opponents; and the outcome of the struggle will be looked for with much interest. The second paper in the *Review* is a rambling dialogue, "After the Play," by Henry James, designed as a critique of the contemporary drama. Earl Compton writes of "The Homes of the People," presenting anew the evils of the tenement-house system in cities, and advocating the erection of new and improved dwellings by the cities themselves. Lord Charles Beresford writes on "National Muscle;" Mrs. Lynn Linton, on "The Religion of Self-Respect;" and Mr. G. W. Russell, on "The Unionist Policy for Ireland." Mr. Russell's paper, though brief, is very suggestive, advocating measures for assisting the Irish tenants to purchase their holdings, and also a system of local government for Ireland similar to that already established in England. The concluding article is by Lady Randolph Churchill, detailing her observations during a month in Russia. It is written in a clear and simple style, and shows great keenness of observation, and will be sure to interest those who like to read about social life and customs. On the whole, the *New Review*, notwithstanding the brevity of some of its articles, promises to be a formidable rival of the older English reviews, as well as of some published in the United States.

—European scholars are devoting much attention at present to the centenary of the French Revolution and its influence upon European politics. The *Fortnightly Review* for June (New York, Leonard Scott Publication Company, 29 Park Row) opens with two papers on the Revolution, — the first, "What the French Revolution did," by Frederic Harrison, a brilliant and scholarly paper; and the second, by Gen. Viscount Wolseley, entitled "The French Revolution and War," in which he investigates the influence which that event exerted upon the science of warfare. The Marquis of Lorne presents a review of "Five Years' Advocacy of Provincial Parliaments," which he suggested some time since as a solution of the Irish difficulty; William Day, in a paper on "Turf Reform,"

argues for the necessity of devising fresh regulations, and instituting more stringent measures for purifying the turf and benefiting the whole racing community; E. C. K. Gonner writes on "The Foreigner in England," and maintains that there are many serious grievances arising from unrestricted immigration to England, calling for immediate action on the part of the authorities; Professor E. A. Freeman contributes a note on "The House of Hapsburg in South-eastern Europe," in which he questions some statements made by Mr. J. D. Bouchier in a paper on the same subject in the March number of the *Review*; Lady Dilke describes some benefit societies and trades unions for women, — a subject of much importance to all laboring women; Dr. Robson Roose presents some good and careful rules on the "Art of Preserving Life;" an anonymous writer criticises some recent changes made by the British Government in the matter of the Egyptian bonds; and Frederick Greenwood contributes an interesting sketch entitled "A Conversation in a Balcony." The number concludes with an eminently readable paper on "The Women of Spain," by Emilia Pardo Bazan.

LETTERS TO THE EDITOR.

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

Cloud and Fog.

THE formation of cloud has been generally ascribed to the rising of a mass of saturated air to a cooler stratum, where the cooling due to expansion and that from the surrounding air produces a supersaturation and visible cloud. Not long since, Mr. John Aitken of Scotland propounded the rather startling theory that cloud could not be formed without the intervention of solid particles of dust, smoke, or other substance. This view was based on laboratory experiments, in which dust-free air seemed to show no condensation upon rarefaction. It would seem as though this view can hardly be possible. If two molecules of vapor have been sufficiently cooled, why may they not coalesce into a double molecule of water? If we consider that each double molecule of water needs a solid particle for a nucleus, there will be needed enormous quantities of these particles in each cloud, and more, it would seem, than can possibly be present in the cloud-forming strata.

A few experiments have been tried in cloud-formation, and a brief review of these is given here, the complete discussion and experimental proofs being reserved for another occasion. Most of the experiments were made with a clear glass water-bottle holding a half-gallon, and having three openings at the top. These were fitted with absolutely tight rubber stoppers having openings, which allowed the use of wet and dry thermometers to determine the moisture, and the use of glass tubes whereby the air could be compressed or exhausted at pleasure. An attempt was made to saturate the air by first passing it through a bottle of water; but, this not succeeding, it was passed through a bottle full of cracked pumice and water, a U-tube of the same, another U-tube having cotton soaked in water, and a straight tube with four inches of cotton (also wet). Near the compressor was a tube having three inches of dry cotton, and in the tube passing into the bottle there was another pledget of cotton. It was still found, after passing through this mass of moisture, that the air was not saturated, and it seems a practical impossibility to perfectly saturate air. Even after heating the bottle and tube of pumice nearly to boiling, the air was not saturated. It would seem as though this might explain in part the non-success of some former experiments in producing cloud in dust-free air.

Experiment 1. — Air was introduced into the bottle, as near saturated as possible, and then the whole was heated to 110°. The dry bulb rose a little faster than the wet. On suddenly cooling the outside, no cloud was observed, nor did the thermometers come together, but moisture was deposited on the sides.

Experiment 2. — The air was again heated to 110°, and it was mingled with nearly saturated air at about 65°. No cloud was observed.

Experiment 3. — The air was again heated, and a small piece of ice was suspended near the top. No cloud was observed, but a

beautiful white streak ran perpendicularly from the ice to the bottom, where it recurved, and finally disappeared in thin filaments. It was discovered that this was due to camphor-smoke purposely introduced. No appearance with ice was noted in dust-free air.

Experiment 4. — Nearly saturated air, with a little smoke, was compressed, and suddenly released from pressure. A haze filled the whole bottle.

Experiment 5. — On repeating this again and again, occasionally introducing a little smoke, it was found that the degree of saturation made little difference. Finally the haze was produced in air having a relative humidity of two per cent and a dewpoint of -21° , the outside air being at about 80° .

Experiment 6. — The bottle was filled full with water, removing every particle of air. All the dust-particles were driven from the compressor, and by it the water was forced out with air nearly saturated. On compressing this air, absolutely dust-free, and releasing it, a beautiful mist of clearly rounded water-particles was noted. The appearance was very different from the cloud-haze before noted, which had no rounded particles, but was an indefinite white haze. The difference between the two could not for a moment be mistaken.

Experiment 7. — On introducing a little smoke, the haze was very prominent at first; but, after a few compressions, the haze began to disappear, and there were seen together both haze and mist. The haze was finally entirely sifted out, but repeated compressions and expansions failed to change the mist in any way.

Experiment 8. — Dust-free air, nearly saturated, was suddenly expanded by an air-pump, and the mist appeared as before under compression, but was much shorter lived. No. 7 was also repeated with the air-pump, but the effects in all cases were less marked than under compression. It appeared in the air-pump experiment as though the mist formed at the top of the bottle, and it was feared that there might possibly be a leakage around the stoppers or tubes. This led to No. 9.

Experiment 9. — The bottle was filled full and inverted, great care being taken that not a particle of dust should get in. A little water was left at the bottom, and this formed a most effectual stop for all ingress of air. The air-pump gave the same mist as before.

The following are the proofs that the mist was formed in nearly saturated air without the intervention of solid particles of any kind: 1. The haze from dust or smoke was entirely different from the mist in dust-free air; 2. It was a very easy matter to sift out the smoke-haze by repeated compressions, but not so the mist; 3. The mist was the same so long as the compression and saturation remained constant (it was impossible to diminish this after hours of labor); 4. The mist settled down to the bottom after each compression, and finally moistened it with drops, showing that an enormous number of mist-globules had settled. If each mist-globule had taken a dust-particle along, it is easy to see that after a very short time every mote would have been deposited.

Conclusions. — 1. It seems practically impossible to perfectly saturate air by cooling, by expansion, by mixture of cold and warm air, by passing through wet substances, or in any analogous manner. 2. This is probably the reason that no permanent haze cloud or mist has yet been formed by direct experiment. 3. Cooling by expansion or in any other way, and consequent condensation, is not needed to display invisible smoke or moisture particles. 4. The mixing of two bodies of air of widely different temperature, and nearly saturated, will not produce a cloud. 5. The sudden cooling of nearly saturated air will not produce a cloud. 6. A velocity of one hundred and more miles per hour of an ascending current will hardly suffice to produce cloud or mist by expansion in nearly saturated air. 7. It seems possible to unite smoke particles so as to form visible haze in dry air. This may be a mechanical aggregation due to a violent bombardment of the particles on sudden expansion. 8. The same statement may be made of moisture-particles in nearly saturated air.

Some of these conclusions are very remarkable, and I sincerely trust that other experimenters will make the few simple trials needed. To one having access to a laboratory the whole expense will be practically nothing.

H. A. HAZEN.

Washington, June 11.

Osteological Notes.

PROFESSOR FLOWER, in his admirable hand-book on the osteology of the *Mammalia*, lays special stress on the disposition of the lateral bones of the cranium as constituting points of difference between the *Catarrhini* and *Platyrrhini*, the Old and New World monkeys.

On careful examination of the skulls in this museum in reference to this subject, I find that there are exceptions to almost every rule, that might be offered, and that authorities differed even on these exceptions. Notwithstanding these differences, however, it may be affirmed that (1) the *Catarrhini*, as is the rule in man, have the alisphenoid join suturally with the parietal and frontal, with one or both, or they may have the squamosal join with the frontal; (2) the *Platyrrhini* have the parietal and malar join suturally, thus preventing the union of the alisphenoid with the parietal and frontal, or of the union of the squamosal with the frontal.

It is generally taught that the *os planum* of the ethmoid enters into the formation of the inner wall of the orbit in man and apes only. Gegenbaur, on this point, says, "Except in some *Edentata*, it is in the Primates only that a portion of the lateral surface reaches to the median boundary of the orbit, where it forms the *lamina papyracea*." The great anatomist overlooks the *Felidae* in the order of the *Carnivora*, in many of which family, as in the domestic cat (*Felis domestica*), in the tiger (*Felis tigris*), in the jaguar (*Felis onca*), and in the lion (*Felis leo*), as well as in several of the *Viverridae*, the *os planum* is distinctly visible in the wall of the orbit.

The perforation of the transverse processes of the seventh cervical vertebra by the vertebral arterial canal, as also the presence of an articular cavity on the hinder edge of the body of this same vertebra for the reception of the head of the first rib, are distinctive characters in some of the orders of the *Mammalia*, and considerable importance has been laid upon their presence or absence in the matter of classification.

Seventh Cervical Vertebra.

Primates.	Transverse Process.	Articular Cavity.
Homo.....	Perforated	Absent.
Gorilla.....	"	Present.
Chimpanzee.....	Imperforate	"
Orang.....	"	"
Hylobates ¹	"	"
Carnivora.....	"	Absent.
Ungulata ²	"	Present.
Proboscidea.....	"	"
"Cetacea.....	Imperfectly developed	"
Sirenia.....	"	"
Insectivora.....	Imperforate	"
Chiroptera.....	"	"
Rodentia ³	"	"
Edentata ⁴	"	"
Marsupialia.....	Perforated	"
Monotremata ⁵	"	"

¹ In the other primates the perforate or imperforate condition of the transverse process of the seventh cervical vertebra varies much. Mivart says that he has never seen it perforated in *Hylobates*, *Myecetes*, *Brachyurus*, *Nyctipithecus*, *Chrysothrix*, *Hapale*, *Lemur*, *Galago-arctocebus*.

² The giraffe has the seventh cervical perforated.

³ *Lepus* has the seventh cervical perforated.

⁴ In the Sloths the three-toed has the eighth cervical perforated, and the two-toed, the sixth cervical.

⁵ The *Echidna* has the seventh cervical imperforate, and the *Ornithorhynchus* has an articular cavity for first rib on the same.

The above table, based upon an examination of the articulated and disarticulated skeletons in this collection, may prove serviceable to those interested.

D. D. SLADE.

Mus. Comp. Zool., Cambridge, Mass., June 12.

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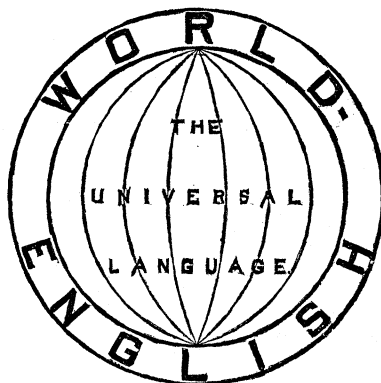
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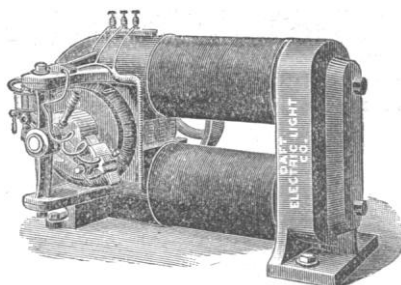
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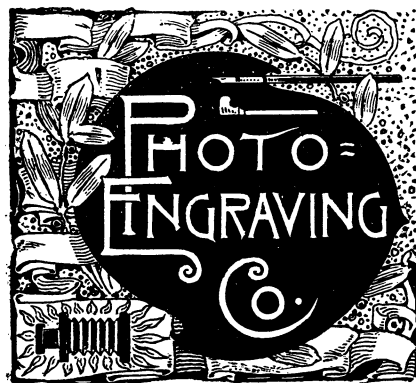
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INDUSTRIAL NOTES.

Electric Shell Hoist for War-Vessels.

WE publish in this issue of our paper a view of one of the electric hoists built by the Sprague Electric Railway and Motor Company of New York, for the new United States cruiser "Atlanta." This hoist is the first of its kind that has been built for this work, and this commencement of the use of electric power on shipboard is most novel, and promises to extend rapidly. The advantages of electric power for the manifold uses on board vessels, over transmission of power by steam to different portions of the vessel, are many, and the general adoption of incandescent lighting on shipboard enables such motors to be operated without additional dynamo installation.

The hoist which we illustrate is of three horse-power, using the regular Sprague graphite brushes, and can be run forwards or backwards with the greatest facility by the simple movement in one direction or another of an electric switch. By means of this same switch the speed can be varied to any degree desired.

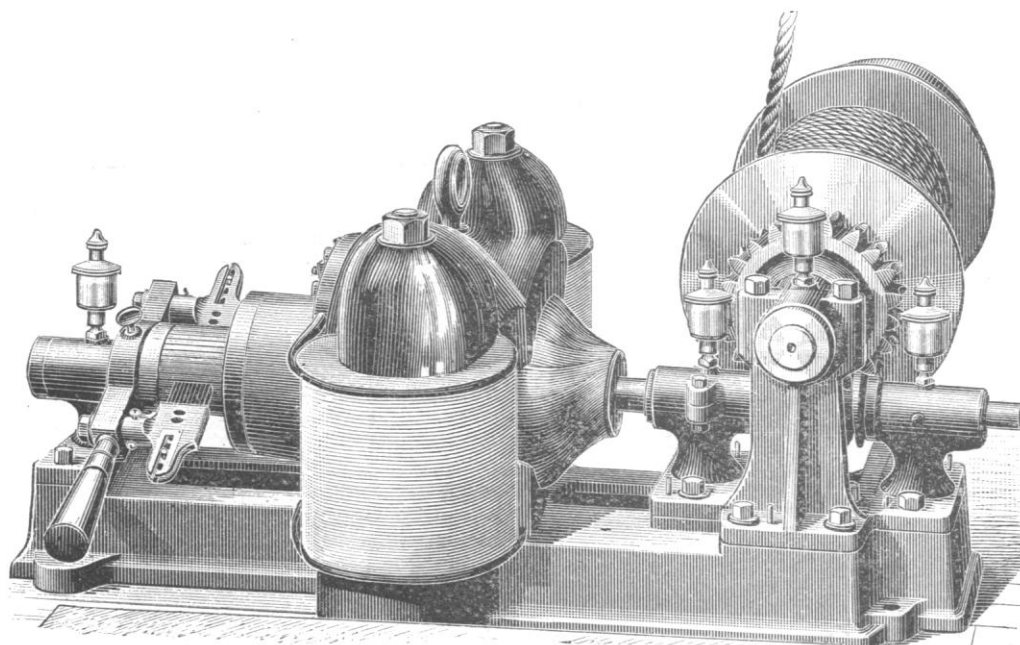
Although built for the special purpose of hoisting shells, this

New York, 50 incandescent; Lawrence Line Company, Lawrence, Mass., 50 incandescent; Riverside Mills, Providence, R.I., 25 incandescent.

The Complete Combustion Boiler.

Mr. Francis E. Galloupe, mechanical engineer, tested the evaporative performance of a 100-horse-power steam-boiler having the downward draught furnace, at the works of the Suffolk Cordage Company, Chelsea, Mass., Feb. 25.

The boiler tested was a horizontal, cylindrical, multitubular boiler, and did not differ in design, either of the general construction or portions occupied by the water and steam, from that of the ordinary form, except in the furnace. The furnace is built of steel plates riveted like those of the shell, and is placed entirely within the shell of the boiler, and surrounded by water spaces. At the back end of the grate a hanging water-leg of steel plates, riveted to the crown sheet of the furnace, extends downward to within eighteen inches of the ash-pit or furnace bottom. The grate is formed of water tubes entering the front side of the water-leg, at the back end of the grate, at a moderate inclination from the hori-



SPRAGUE ELECTRIC SHELL HOIST.

combination promises to meet a large demand for small hoists in manufacturing and other industries, where the small space occupied by an electric motor is quite a desideratum.

The tendency among the leading electric supply companies seems to be gradually towards electric motor combinations with other machines, like the above; and experience shows that such combinations create a demand as their advantages become recognized.

New Electric-Light Plants.

The Thomson-Houston Electric Company reports the following sales: Narragansett Pier, R.I., 30 arc, 1,000 incandescent; Seattle, W.T., 50 arc; Brockport, N.Y., 20 arc; Troy, O., 50 arc; Somerville, Mass., 100 arc; Binghamton, N.Y., 150 arc; Philadelphia, Penn., 100 arc; Lowell, Mass., 50 arc; Boston, Mass., 1,000 alternating; Springfield, Mass., 90 arc; Minneapolis, Minn., 150 arc, 1,200 incandescent; Rochester, N.H., 50 arc; Chelsea, Mass., 100 arc; Norwich, Conn., 400 incandescent; Goldsboro, N.J., 45 arc, 600 incandescent; Sorrento, Me., 30 arc. They also report the following isolated plants: Wamsutta Mills, New Bedford, Mass., 400 incandescent; Bennett Manufacturing Company, New Bedford, Mass., 600 incandescent; Whittle & Hanrahan, Providence, R.I., 15 arc; H. Ricker & Sons, Poland Springs, Me., 12 arc; Jewell Milling Company, Brooklyn, N.Y., 300 incandescent; M. W. Hyer,

zontal, and enters a gun-metal box in front, just below the furnace doors. Return tubes, also inclined, extend from this box beneath the great tubes back to the water-leg, and insure a circulation of water from the main shell and water-leg, through the grate tubes. The space beneath the grate, ordinarily the ash-pit, is the combustion-chamber, the air for combustion being admitted through the fire-doors above the grate, and drawn down through the grate-bars by the chimney draught, where it becomes highly heated before or during its combination with the hot gases from the coal. Beyond the water-leg, extending up to the crown sheet of the furnace, is an extension of the combustion-chamber, which forms the passage to the tubes, the tube sheet being eighteen inches horizontally from back of the water-leg. The hot gases pass from this point through the tubes, which form a large absorbing area, directly to the uptake and chimney.

The position and arrangement of the furnace resemble that in the locomotive boiler, with the addition of a deflecting arch, which tends to mix the hot gases on their way to the tubes, and, as would be expected from this construction of an internal furnace entirely surrounded by the water-heating surfaces of the boiler, the boiler made steam very quickly, and almost immediately on lighting the fire.

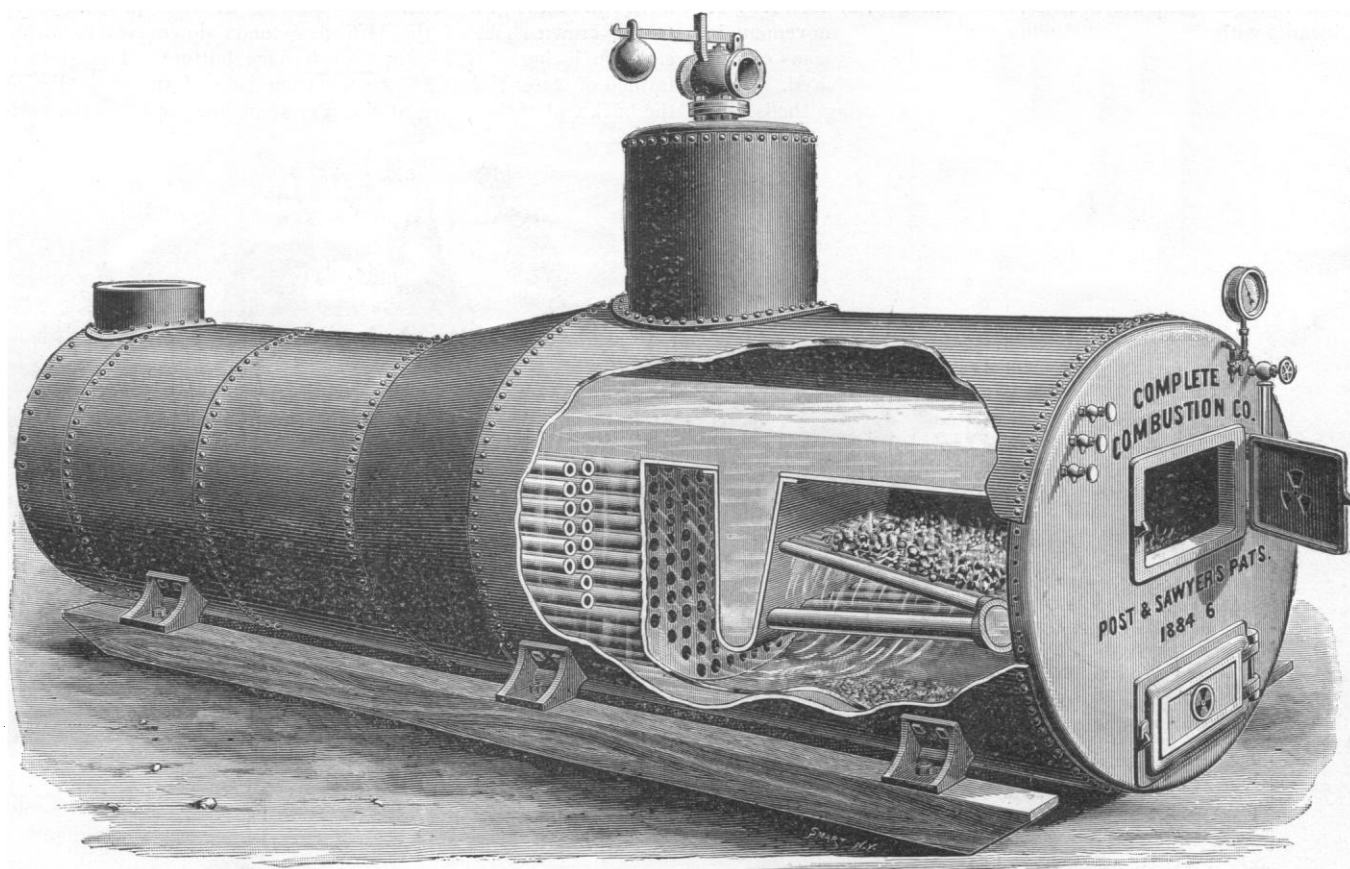
During the trial a large Brown engine, stated to have been developing about 210 horse-power, was run by the steam from the

boiler under test, in connection with one other boiler of usual form ; and although all the machinery of the works, including about 35 horse-power used in running generators for electric lights, was thrown on the engine, no difficulty was found in holding the steam-pressure required, with the flue damper one-third open, and fire-doors closed or placed ajar for a considerable portion of the time. The boiler showed considerable reserve capacity for an increase of power, whenever a demand was made upon it.

In the matter of safety it would seem that this construction is safer than the ordinary form. The crown sheet over the furnace has usually the least depth of water over it of any plate in a boiler exposed to the action of the fire, and is at the same time exposed to the fiercest temperature of the fire. The result of low water, should the crown sheet not be covered, would be, in the ordinary case, to burn the plate, with a resulting bulging of the sheet, or

great a quantity of air, which would be heated and wasted ; or (3) by too strong a draught in the flue to the chimney, which would take off the hot gases before there was time for the absorption of their heat by the boiler. At the beginning of the test the flue damper was open, and the temperature in the uptake was 590° F. On closing the damper to about one-third opening, at which point it was kept during the remainder of the trial, temperatures varying from 330° to 375° F. were obtained. At the steam-pressure carried, the temperature of the steam and water in the boiler was about 330° F., showing that the loss of heat above this temperature through the chimney was very small, varying from nothing to at no time more than about 40° F.

The firing was skilfully managed, and, so far as could be determined, no unnecessary amount of air was admitted. The percentage of refuse to the coal burned (9.91) shows that the coal, which



COMPLETE COMBUSTION BOILER.

perhaps the explosion of the boiler. In this boiler the hottest temperature of the fire is beneath the grate, where all the surrounding surfaces are protected by water, which instantaneously absorbs the heat coming in contact with them ; while the direction of the draught being downward and away from the crown sheet, and the latter being still further cooled by the entering air used for combustion, the crown sheet is kept comparatively cool, with, in any case, little probability of burning. Should the water-level be lowered below the grate, the grate-tubes would burn off, and destroy the fire.

An important advantage in supplying the air above the grate is that it is never necessary to open the combustion-chamber to the outside air, which cools the entire boiler, and causes loss of heat in the ordinary boiler whenever the furnace is fired. Throughout the trial the ash-pit doors were kept closed.

The boiler was covered with asbestos, brick setting being unnecessary on account of the use of the internal furnace. Since the radiation from the steam and water surfaces of the boiler was reduced by the covering to a minimum, the only losses of heat that could occur were either (1) by not supplying air in the right quantity or manner to consume the coal perfectly ; (2) by admitting too

was the best dry Cumberland to be had, was quite perfectly consumed.

From the above considerations and conditions, it would be expected that this boiler, properly run, would give high economical results. These were an evaporation from an average temperature of $53\frac{1}{2}^{\circ}$ F. into steam of an average gauge pressure of 80 pounds, of 9.82 pounds of water per pound of coal. The equivalent evaporation, reduced to the standard of from and at 212° F. was 11.78 pounds, and per pound of combustible, 13.08 pounds. The average result of a large number of tests made with different boilers at the Centennial Exhibition of 1876 was 10.99 pounds of water per pound of combustible.

The boiler shows, as above, good proportions ; and the conditions of setting, draught of chimney, etc., were favorable. The steam appeared to be of excellent quality, free from moisture, and there was no priming. The coal was charged as dry coal, no deduction being made for moisture. The water-consumption was accurately obtained by weighing all the water fed to the boiler, and there was no leakage. The water-level in the boiler was the same at the beginning and end of the test, and the steam-pressure made uniform at both times.

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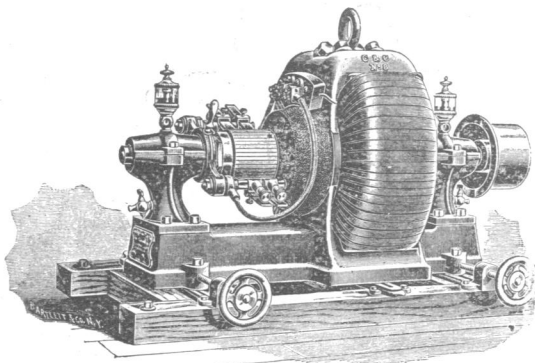
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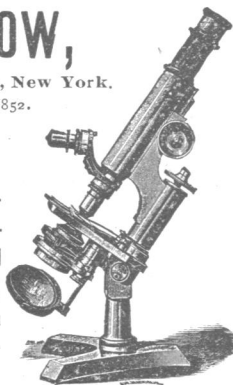
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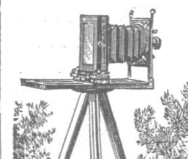
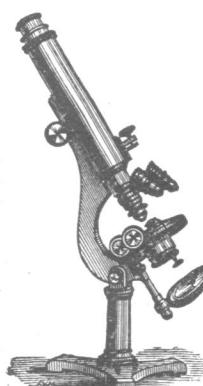
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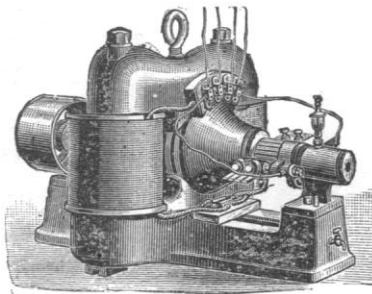
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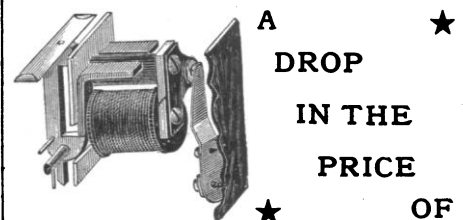
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